Resource Efficient Management of Chemicals

in Textile and Leather Sector Companies

Company Handbook

Skip introduction

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Implemented by:
giz Deutsche Gesellschaft für Internationale Zusammenarbeit (GIZ) GmbH

ABOUT THE HANDBOOK

The objective of this handbook is to provide practical guidance to personnel of factories in the textile and leather sector who are involved in the implementation or upgradation of resource efficient management of chemicals in their respective factories.

The handbook contains worksheets, handouts, presentations as well as reading materials to provide a ready reference for the different steps of implementing chemical management system elements and good chemical management practices.

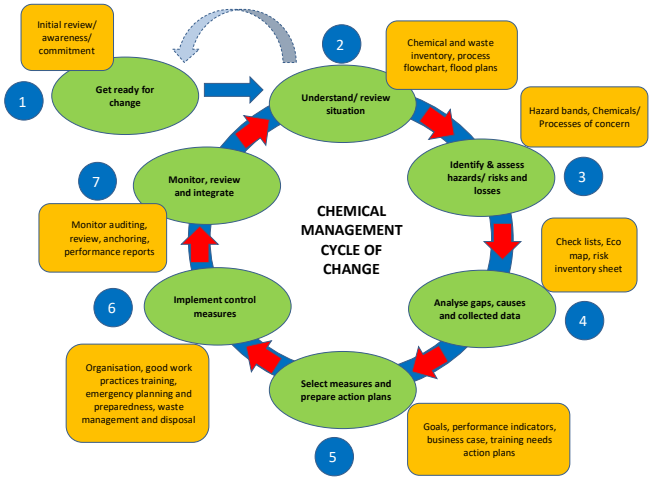
The materials are arranged in form of training units along the seven steps of the “Resource Efficient Management of Chemicals” (REMC) cycle of change and closely follow the recommended structure and content of the Zero Discharge of Hazardous Chemicals (ZDHC) Chemical Management System Guidelines.

The revised handbook has been developed on basis of the earlier GIZ Chemical Management Toolkit for Small and Medium Scale Enterprises.

Furthermore it refers to publications of UNEP, UNIDO, ILO, HSE (UK), BAUA (Germany) and ICCA.

IMPLEMENTING RESOURCE EFFICIENT MANAGEMENT OF CHEMICALS - SUMMARY

In line with the PLAN-DO-CHECK-ACT cycle, common to many management systems, the process of implementing of chemicals management in this handbook follows a cycle of change, consisting of seven main steps.



Step 1	**Get ready for change**	☐	Conduct initial review
		☐	Ensure commitment (time, resources) in your company
		☐	Get your team together
Step 2	**Understand and review the situation in your company**	☐	Analyze material flows (particularly of chemicals) in your enterprise and identify NPOs
		☐	Identify areas for immediate improvement (“hot spots”)
		☐	Systematically identify and document all chemical substances stored and used in your enterprise
Step 3	**Identify and assess chemical hazards of the different chemicals in use**	☐	Create a structured information base in form of a chemical inventory
		☐	Identify and assess hazards
		☐	Classify chemicals by hazards
Step 4	**Identify and assess risks and control gaps**	☐	Assess risks to health, safety and environment and identify control gaps and losses
		☐	Analyze gaps and their causes for preparation of action plan
		☐	Identify and document processes and chemicals of concern
		☐	Prioritize areas and chemicals for interventions
Step 5	**Develop your plan**	☐	Identify and select possible measures
		☐	Decide on objectives, targets and indicators
		☐	Prepare action plan with specific measures
		☐	Assess training needs and develop training plans
Step 6	**Put chemical management into practice**	☐	Implement action plans and test good practices
		☐	Train your staff and workers
		☐	Prepare for emergencies
Step 7	**Monitor, review and follow-up**	☐	Review and report results
		☐	Plan next (cycle of) steps
		☐	Integrate results into your company

BACKGROUND AND CONTEXT OF THIS TOOLKIT

In order assist companies at the different stages in the supply chain to ensure the safe and sound use, handling and disposal of chemicals the Deutsche Gesellschaft fuer Internationale Zusammenarbeit (GIZ) developed a Chemical Management Toolkit in 2006, which particularly aimed at small and medium-scale companies.

Since then new references, such as the European chemical legislation REACH, the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) and various supply chain driven initiatives, for example Zero Discharge of Hazardous Chemicals (ZDHC), DETOX, Bluesign, have merged.

To incorporate these changes, a team of experts and trainers under the GIZ Programme for Promotion of Social and Environmental Standards (PSES) in Bangladesh initiated steps in 2016 to further update and adapt the toolkit to the specific needs of manufacturers in the textile and leather sector.

The revised toolkit provides practical step-by-step explanations to the persons involved in the management of chemicals in such manufacturing companies on how to

(i) set up a chemical management systems;

(ii) implement chemical risk control; or

(ii) simply update specific aspects in the company`s existing management practices.

With regard to the setting-up of a chemical management systems, the revised toolkit closely refers to the Chemical Management System Guidance (CMS) Manual published by the Zero Discharge of Hazardous Chemicals (ZDHC) Foundation in September 2015.

This toolkit is also meant to serve as a reference for service providers (e.g. service cells in industry associations, business intermediaries, training, advisory or audit service providers, who want to assist companies in these efforts.

HOW TO NAVIGATE THE HANDBOOK

On the main navigation page, you will find the graphic as shown on the right hand side. This page provides you with an overview of what guidance you can find in this handbook for establishing a chemical management system as well as for implementing good chemical management practices in your company.

If you know already what you are specifically interested in, click on the appropriate section of in the graphic. If you are not sure, click on section 1 and start with “Getting ready for change”.

In each of this sections you will find

- further explanations on how to address this topic,
- links to templates, worksheets, checklists, tools which you can use while practically implementing the respective chemical management element or practice in your company, and
- links to further information in internet

In case you are just looking for some reference materials click on “reference materials”

How to navigate

Move back		Go to overview	
Move forward		Go to beginning of section	

Ready start? Then press this button

Select the area of your interest

Reference materials

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STEP 1

GETTING READY FOR CHANGE

This section will help you with starting your work on the chemical management system in your company.

To establish a good foundation for such chemical management system, take a look at the list of tasks on the right side.

Move to the next page, if you want to start from task 1.1. or click on the specific task/ element to directly move to the respective page.

In case you want to learn more about what is expected from you according to ZDHC, click on „ZDHC CMS References“ to access the ZDHC CMS Guidance Manual.

Tasks/Elements

ZDHC CMS References

ZDHC CMS 1.1 Review existing company policy

ZDHC CMS 1.2 Define scope of the Chemical Management (System)

1.1 OBTAIN MANAGEMENT COMMITMENT

The commitment from the top decision makers is a pre-requisite for implementing any major change in an organization. Accordingly, incorporating chemical management into strategic and operational planning, day-to-day management and decision making at all levels your organisation will require the full support from the top management. This may manifest itself in various forms; for example:

(1) A policy or management statement indicating the organization´s commitment towards chemical management is formulated

(2) A clear mandate to the team or persons tasked with implementing chemical management is given

(3) Resources (facilities, personnel, time, funding) are provided to the change team involved.

Does your company have a policy on chemical management?

1.1 OBTAIN MANAGEMENT COMMITMENT

Formulate a company management policy

A company policy shows the direct participation by the highest-level management in all specific and important chemical management aspect or programs of an organization.

The company policy is a broad statement of goals or commitment formulated by the top management which is made known to your, your managers, workers and other stakeholders who deal with the enterprise. The policy guides you on the way do your jobs a as well as carry out decisions.

In case the company has already formulated a related policy, for example as part of an environment, health & safety or other management system, the first step would involve a review of the existing company policy/ies to verify whether the commitment towards chemical management is reflected.

"It is the policy of our company to protect our workers and the public, prevent incidents, protect the environment through integration of environmental stewardships and sustainability throughout the life-cycle of its activities, and ensure regulatory compliance."

A management policy should

- ☐ allow to anticipate and respond to changing social, environmental and legislative conditions
- ☐ include a goal of zero discharge of hazardous chemicals throughout a product 's life cycle
- ☐ integrate into the management culture
- ☐ set targets to improve or maintain performance against best available technique
- ☐ refer to adherence to sustainable chemistry practices
- ☐ be appropriate to the organisation's purpose
- ☐ be communicated widely inside and outside the organisation
- ☐ aim towards creating framework for continuous improvement

1.1 OBTAIN MANAGEMENT COMMITMENT

Formulate a company management policy

A policy statement on the management of chemicals might include the following commitments (examples):

„Safe procedures and practices will be established for the transport, use and disposal of hazardous chemicals.“

„The management will ensure that the workers have the right to be fully informed on the hazards of chemicals and to be thoroughly training in the safe handling.“

„Before any chemical is brought into the enterprise, information on that chemical should be provided by the supplie, manufacturer or importer“

Guiding questions

- ☐ Can you describe your company policy/commitment fo a chemical management programme?
- ☐ Does it include any statements in line with the examples given?
- ☐ Can you identify who is directly responsible for the impementation of the policy within the company?

ZDHC reference:

▶ ZDHC CMS 1.1 Review existing company policy

1.2 CREATE IN-HOUSE AWARENESS AND READINESS TO CHANGE

The implementation of any change requires the buy-in of those who need to contribute or may be affected. This primarily is the case with the people working in your organisation.

According to studies, the willingness to change will depend on following factors…

the degree of dissatisfaction with the current situation	For change to take place and the necessary motivation to develop, there has to be a sufficient degree of dissatisfaction with the status quo; otherwise, energy for change cannot be mobilised (no pain no change!). If painful pressure in the company (losing money, pollution is too high etc.) is not high enough, little can be moved, even if there is strong external influence by consultants or external funds.
the clear or publicly announced desired state (situation) in the future	A change process will only be successful if there is a clear perception of what the situation could look like once the change has been successfully implemented, i.e. the future situation (joint figure building: we go through six clearly defined steps, starting with the flowchart and finishing with the evaluation and integration into every day procedures etc., chemical management system as ZDHC implemented).
the first practical steps into the direction of the desired future state (situation)	There are clear, manageable and realistic action plans which soon can lead to first successful measures.
the 'costs' of change (both financial and emotional)	For change taking place, the first three factors must be stronger than the costs of change. These can be either material (e.g. investments) or immaterial costs (e.g. fear, anger, uncertainties,…).

Source: PREMA Good Housekeeping Guide

1.2 CREATE IN-HOUSE AWARENESS AND READINESS TO CHANGE

WHAT YOU CAN DO…

the degree of dissatisfaction with the current situation
the clear or publicly announced desired state (situation) in the future
the first practical steps into the direction of the desired future state (situation)
the 'costs' of change (both financial and emotional)

- Prepare the stakeholders in your organisation (company, unit, area). Your management plays a crucial role in communicating and leading => Why, what, how.
- Initiate and implement improvements measures during the initial stage, which are easy to implement and yield quick and visible results. This will raise the readiness for change and create the necessary dynamics for continuing the change.

1.3 FORM A CHEMICAL MANAGEMENT CHANGE TEAM

The implementation of chemical management (including of a supportive chemical management system) also requires the establishment of an organisational structure (roles & responsibilities) which will happen in course of the implementation of these steps. At the beginning, it is important that a team is formed which will receive a clear mandate (terms of reference, job description) from the management.

The core Chemical Management (CM) Team will be responsible for supervising the implementation of the chemical management steps. A sub-team can assist the core team on specific areas and functions. The assignments may be system-wide to follow the flow of a process from the input through to the output phase, or it may be divided by phase, or it may be divided by departments. The composition should also suit the culture of the organization.

1.3 FORM A CHEMICAL MANAGEMENT CHANGE TEAM

Experience shows that such teams should not be simply formed based on one person from each department. A needs analysis should drive the selection of members. Smaller organizations with less resources may seek external assistance. An external consultant need not be a professional consultant; but someone from your supply chain, either upstream or downstream, may also fulfil this role.

Be aware that as the scope of the tasks change, so may change the team. Evolve the composition of the team to match the dynamic nature of the task. In larger firms, there may be different levels of teams, and different teams in operation at the same time.

Guiding questions

- ☐ Can you name the group which takes the initiative of establishing a plan and monitor its implementation for the management of chemicals in your company?
- ☐ Can you describe the roles and responsibilities of management and workers in your company concerning the safe use of chemicals?

1.3 FORM A CHEMICAL MANAGEMENT CHANGE TEAM

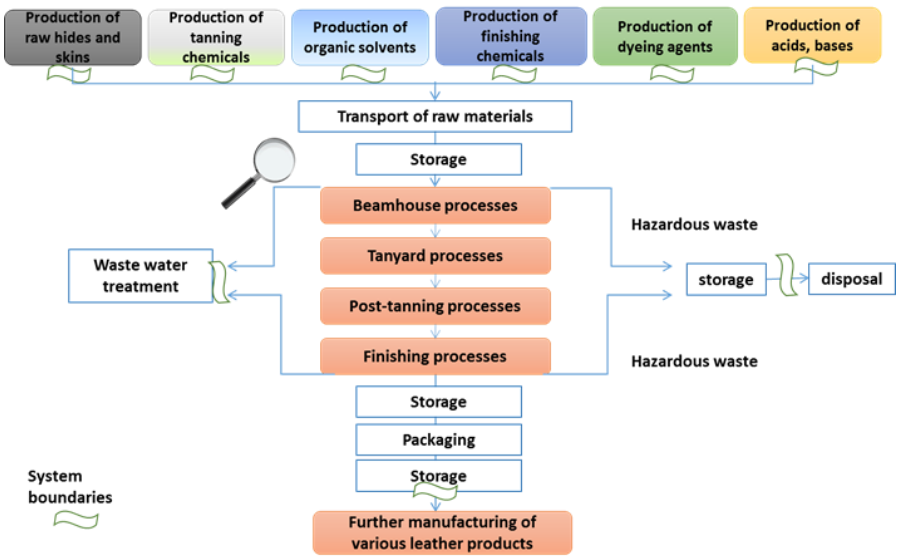
Function/ Department	Roles and responsibilities
Purchase	Develop and implement controls of materials, maintain inventory, procure information on material hazards, environmental impacts, and eco-friendly alternatives.
Human Resources	Define competency requirements and job descriptions for various roles in CM. Develop training programs based on a needs analysis. Integrate the CM system into reward, discipline and appraisal systems.
Maintenance	Implement preventive maintenance for key equipment. Track equipment performance, cost efficiency, etc.; maintain logs and inventory on equipment, machine parts, etc.
Legal/Compliance	Check requirements on compliance to all applicable regulations and laws, update legal documents, communicate risks of non-compliance.
Finance	Evaluate CM options for economic feasibility; prepare budgets for CM options; track data on costs incurred and benefits accrued in CM program.
Engineering/ Production/ EHS	Prepare relevant drawings such as process flow diagrams, eco-maps, control charts, check Sheets, prepare material balances; carry out benchmarking; set objectives and targets; develop performance indicators; generate and evaluate CM technical options; prepare implementation plans; implement CM options; carry corrective actions if required; support training of line workers.

1.4 DEFINE THE SYSTEM SCOPE

As with any other management systems, a company that wants to implement a chemical management systems (CMS), needs to clearly define the scope of the system by mentioning and documenting the boundaries of the organization to which the CMS applies. Depending on the manufacturing processes the scope may include either the entire organization or specific operating units.

At a minimum, it is recommended that all production facilities and units using chemicals are included into the scope. Pay special attention to the consideration of aspects such as chemical purchase and disposal of chemical waste.

It is important that you complete this in consultations with you stakeholders to avoid later problems and/or misunderstandings.



Example: Leather manufacturer (Source: BiPRO, Germany)

The flag symbol indicates the boundaries of the systems.

ZDHC reference:

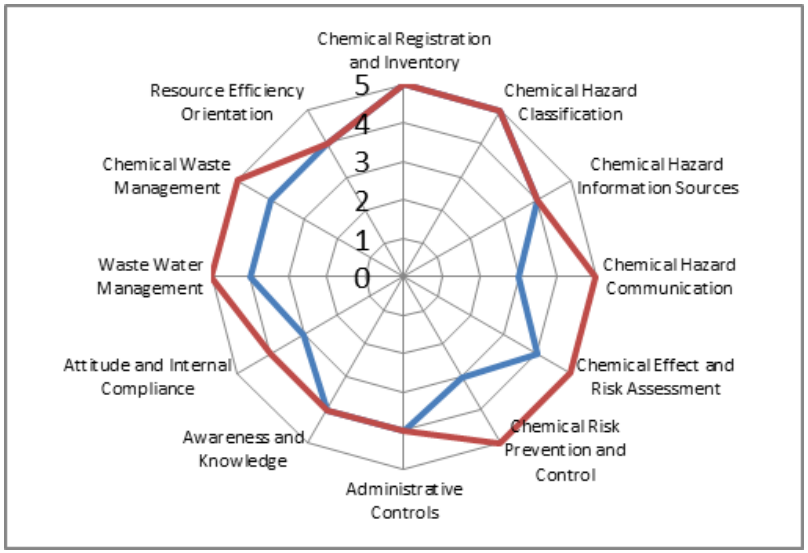
- ZDHC CMS 1.2 Define scope of the Chemical Management (System)

1.5 COMPLETE A PRELIMINARY ASSESSMENT

As a preparatory step for the implementation of chemical management (CM), it may be helpful, if your CM team gets a quick idea of the situation and challenges at hand.

For this purpose, your team can conduct a comprehensive self-assessment, for example using the ZDHC audit protocol or checklists such as in the ZDHC Chemical Management System Guidance manual.

Alternatively, the team can carry out a preliminary assessment, using the GIZ REMC Quick-Check tool to identify and document areas of special attention. The interactive approach of the REMC quick-check tool encourages the involvement of the organisation`s staff at all levels and can contribute to creating awareness and change readiness in the organisation.



Refer to the links on page “Useful links for completing Step 1” to access some practical preliminary assessment tools

USEFUL LINKS FOR COMPLETING STEP 1

Click on the green document icons to get further information

For further information and use *Some useful links*		
	REMC Quick-check tool	Simple checklist-based scoring tool using 12 questions to assess where your organisation stands and documenting the results in form of a spider web diagram
	REMC maturity matrix	Simple two-page management scoring tool using situational descriptions to assess, document and report where your organisation stands.
	ZDHC CMS Self-assessment checklist	Checklist in the attachment of the ZDHC CMS Guidance manual which allows you verify at which level you stand with regard to ZDHC CMS.
	REMC - Good practices and procedures checklist	Checklist in the attachment of the REMC - Good practices and procedures checklist which will help you to identify areas where you can further improve your chemical management systems as you move towards excellence in best practice

STEP 2

UNDERSTANDING THE SITUATION

This section will guide you on how to analyse the process and chemical flows in your company and the establish first crucial elements of your chemical management system.

While completing the tasks and corresponding activities, you will find answers to questions such as

- What chemicals do we use in our company?
- Where are these chemicals present and used?
- How do these chemicals move through our company?
- Where to these chemicals and end in which form?
- What are the relevant legal and other requirements?

Tasks/Elements

2.1. Analyse and document process and chemical flows

2.2. Prepare chemical inventory

2.3. Prepare NPO/waste inventory

2.4. Identify and document regulatory requirements

ZDHC CMS References

ZDHC CMS 2.1 Systematically Identify and Document Chemicals Used and Stored in Your Organization

ZDHC CMS 2.2 Regulatory Assessment

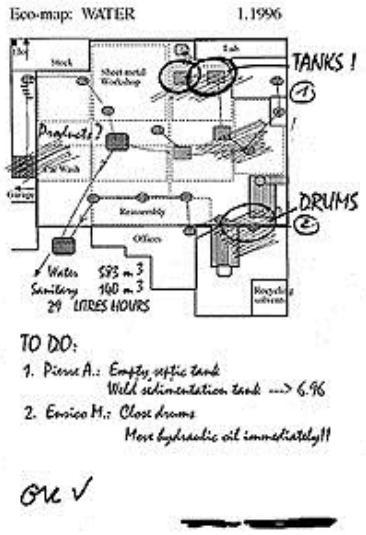
2.1. ANALYSE AND DOCUMENT PROCESS AND CHEMICAL FLOWS

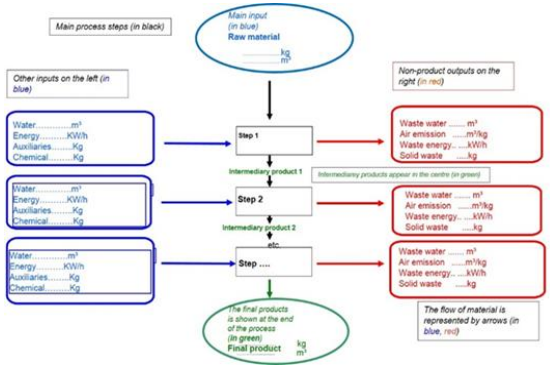
The analysis and documentation of the chemical process flows lays the ground work for inventorying of chemicals and establishing chemical management system framework for promoting responsible usage and prevention of adverse impacts on environment, health and safety as well as losses in your company.

This also makes it easier for you to later identify and document hazard/risks related to entire range of production processes, products, non-product outputs (NPO) activities under the purview of your company as well as plan and monitor your improvement measures.

The toolkit refers to the following two ways of documenting the chemical process flow

1. Eco-mapping
2. Process flow diagrams





2.1. ANALYSE AND DOCUMENT PROCESS AND CHEMICAL FLOWS

HOW TO PREPARE AN ECO-MAP

(1) Start with creating a facility plan that details the physical areas of the property involved in chemical storage and usage. The simplest way is to use existing plans of your company.

(2) Indicate and individually label all areas where chemicals are stored, handled, used as well as released (to air, water,...). It is recommended that your facility plan clearly points out (a) Purchasing and delivery areas, (b) product storage areas (main stores, sub stores, temporary storage areas), c. product preparation/dosing areas, (d) areas with presence of chemical containing air emissions, solid waste and effluent).

In order to increase your understanding of the situation at hand and possible issues to be addressed, the eco-map can also indicate where and how chemicals are transported in your company (see example on left side)

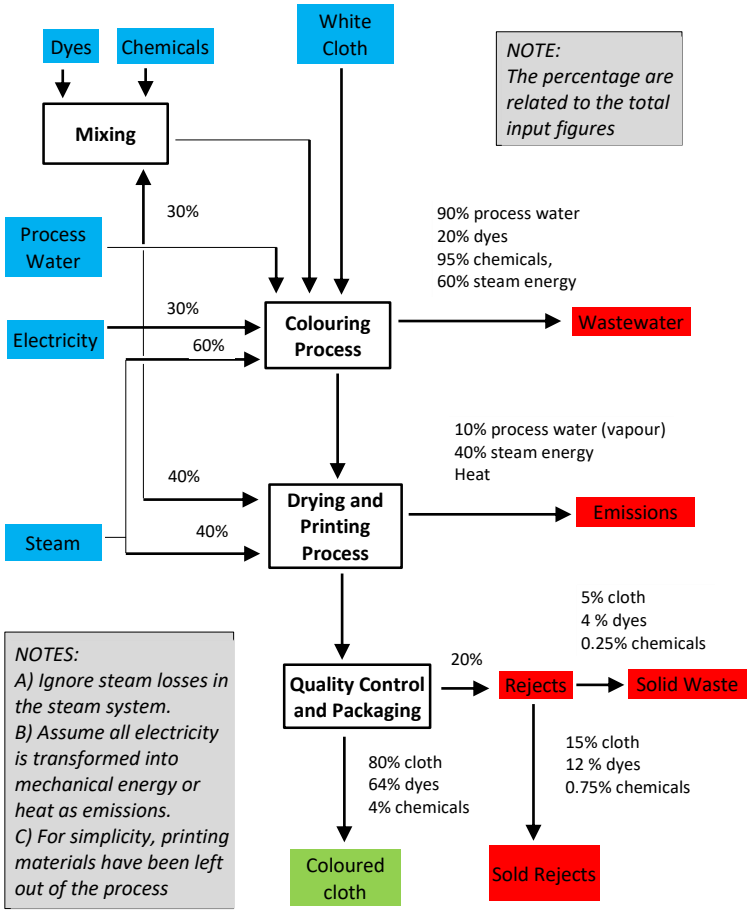
Example: Eco-map of small textile company (Source: GIZ CHS)

Practical tips:

- Prepare or verify during an initial company/site walk-through
- Collect and fill in additional information, using guiding questions and observations on site
- Involve your staff and workers in the preparation of the maps

2.1. ANALYSE AND DOCUMENT PROCESS AND CHEMICAL FLOWS

HOW TO PREPARE A PROCESS FLOW DIAGRAM



The process flow diagram represents a schematic of the production/process steps, different inputs, intermediary products, final product as well as non-product outputs (defines as materials which do not end up in the final product). It will allow you to prepare mass balance and/or cost analysis as well as identify where you can encounter opportunities for cost savings.

(1) Draw a general outline of your production process first. You can always prepare separate and more detailed diagrams for each production steps and process.

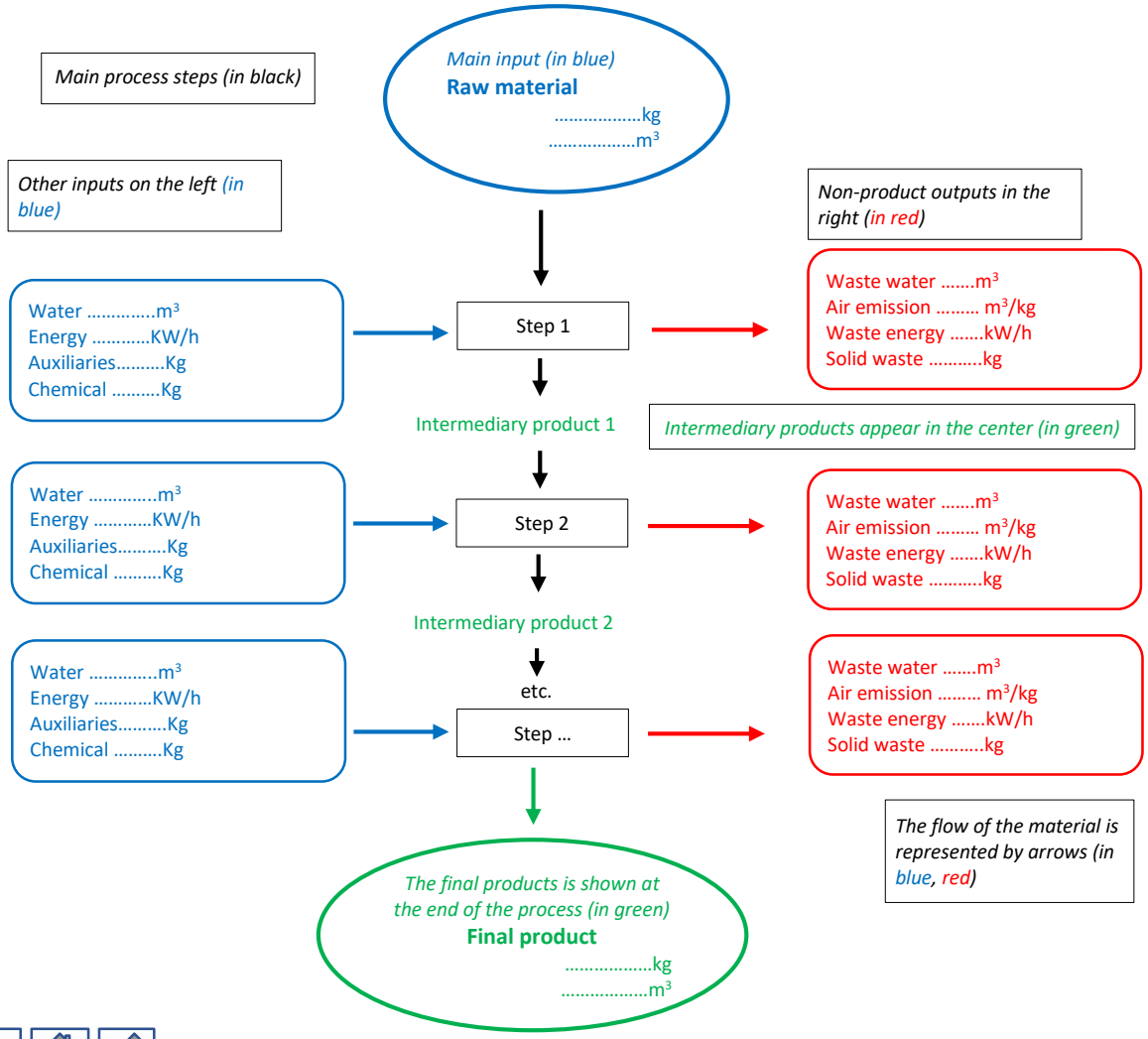
(2) Include inputs, outputs and non-product outputs. In second step start differentiating and detailing these.

(3) Indicate quantities and/or value of inputs, outputs, non-product outputs as far as already known to you. In case of batch processes, in which the input and quantities may vary from product to product this may not be feasible.

Example: PREMA EoCM

2.1. ANALYSE AND DOCUMENT PROCESS AND CHEMICAL FLOWS

HOW TO PREPARE A PROCESS FLOW DIAGRAM



Practical tips:

- Use different shapes and colours to distinguish between inputs, processes, intermediary products, final outputs and non-product outputs.
- These documents, together with the chemical and waste inventories (see 2.2. and 2.3) will form a backbone for your chemical management control process.

2.1. ANALYSE AND DOCUMENT PROCESS AND CHEMICAL FLOWS

HOW TO PREPARE A PROCESS FLOW DIAGRAM

To check whether your flow chart contains all relevant information, aske yourself the following questions:

☐ Have all important inputs in each production process been considered?

☐ Can you recognise the sources of your non-product outputs?

☐ Have you been able to quantify inputs, outputs and non-product outputs?

☐ Can you clearly assign monetary values to the inputs, outputs and non-product outputs?

☐ Are there any information gaps, for which you need to collect further information?

Practical tips:

- Always combine the analysis and preparation of the diagrams with a site visit.
- While compiling this information, it is always beneficial to involve other person in your company in preparing or reviewing the process flow diagram. This brings together a wide scope of experience and knowledge. For example, invite your staff in various production areas to prepare specific eco-maps for their work areas. This allows you to get them actively involved in the whole process from the very beginning.

2.1. ANALYSE AND DOCUMENT PROCESS AND CHEMICAL FLOWS

IDENTIFY AREAS WHICH MAY NEED IMEMDIATE ATTENTION („HOTSPOTS“)

According to some owners/managers of companies that have given attention to chemical management, the analysis and documentation of process and chemical flows in combination with a walk-through visit helps to systematically identify areas which may need immediate attention.

For the walk-through, team up with colleagues and co-workers => two pairs of eyes see more than one. Do not only rely on your own observations but involve worker to clarify the situation on-site.

Mark the hotspots in your eco-maps and prepare short-term action plans to rectify the situation. Addressing these and gaining short-term benefits of such efforts will help you to sensitise your management, colleagues and workers to chemical management This will smoothen the path towards a more systematic approch for chemical management and can also leads to a change in organisational culture with focus on continuous improvement.

„Hotspots“ are areas where you may observe:

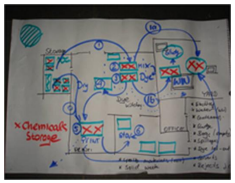
- Obvious economic losses due to inefficient storage, handling, use and/or disposal of chemicals and where immediate improved practices can lead to cost savings
- Immediate risk to you and/or workers health and safety as well as to environment

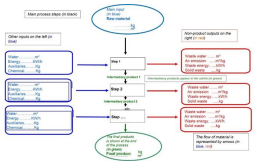
USEFUL LINKS FOR COMPLETING STEP 2, TASK 2.1

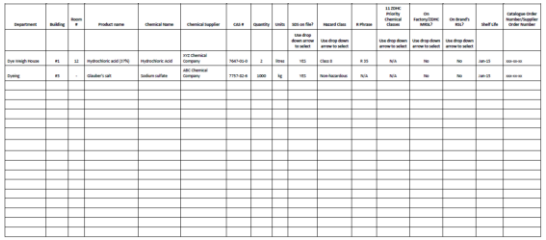
Click on the green document icons to get further information

For further information and use ***Some useful links***		
	Eco-mapping	Handbook on eco-mapping as visualization and documentation for various environmental aspects.
	EMAS Easy	Handbook for implementing a simple environmental management system, based on Eco-mapping.
	Process flow diagram	Standard process flow diagram template

2.2. PREPARE A CHEMICAL INVENTORY







When chemicals constitute a key production input in your company, your company will most likely already maintain a record of the chemicals for purchase and stock management purposes. From your eco-maps and process flow diagrams (see 2.1) you can retrieve information about type and location of chemicals and chemical (containing) waste, production process involving chemicals as well as about quantities of inputs and non-product outputs

In the context of resource efficient management of chemicals, the purpose of chemical inventory goes beyond warehousing requirements. The chemical inventory serves as key reference and chemical management information tool, for example to allow you to assess conformance with restricted substances lists or to report to your company stakeholders (e.g. buyers).

As per ZDHC, the company is expected to create and maintain a comprehensive chemical list, allowing all chemicals in the facility to be identified by name, also recording hazard class, container size, locations of containers and dates on which solutions were prepared or expire, if applicable and chemicals of concern for your customers. In further course, the inventory is expected to be also used for identification and assessment of environment, health & safety hazards and risk.

2.2. PREPARE CHEMICAL INVENTORY

HOW TO PREPARE A CHEMICAL INVENTORY IN LINE WITH ZDHC REQUIREMENTS

1. Decide on a standard format of the enhanced chemical inventory. Appendix C of the ZDHC CMS Guidelines includes an outline of a recommended chemical inventory. You can add further columns in line with your requirements.

2. Referring to your existing inventory or using the findings from your eco-maps and flow-diagrams, fill the information into the inventory template.

Depart. / location/ building	Product name	Chemical name	Chemical supplier	CAS	Quantity	Units	SDS on file	…….
Dye house 1	Hydrochloric acid (37%)	Hydrochloric acid	XYZ Company	7647-01-0	2	Litres	YES	…….
Dye house 1	Glauber‘s salt	Sodium sulphate	ABC Cooperation	7757-82-6	1000	Kg	YES	
……								

2.2. PREPARE CHEMICAL INVENTORY

Chemicals that **MUST** be included are…

- (a) all chemicals with hazard indication or pictogram on container label,
- (b) all chemical materials used in laboratory, pilot facilities and other locations
- (c) all compressed gases,
- (d) any flammable paints, solvents, glues, fuels and other petroleum product, and
- (e) materials that create an explosive or toxic vapor hazard to unprotected personnel during fire emergencies.

Depart. / location/ building	Product name	Chemical name	Chemical supplier	CAS	Quantity	Units	SDS on file	.....
Dye house 1	Hydrochloric acid (37%)	Hydrochloric acid	XYZ Company	7647-01-0	2	Litres	YES	.....
Dye house 1	Glauber's salt	Sodium sulphate	ABC Cooperation	7757-82-6	1000	Kg	YES	
.....								

Explanatory note:

CAS (Chemical Abstract Service)

refers to a registry number which serves as a unique numerical identifier assigned by the Chemical Abstract Service, a division of the American Chemical Society, to every chemical substance described in the open scientific literature. You should be able to find the CAS registry number of the chemicals used in your company on the chemical container/package and or in the safety data sheet. If not available, inquire with your chemical supplier and/or check with one of the CAS registry number search engines in the internet.

Before you start:

Do have the up-to-date safety data sheets of the chemicals (SDS) on file?

2.2. PREPARE CHEMICAL INVENTORY

HOW TO PREPARE A CHEMICAL INVENTORY IN LINE WITH ZDHC REQUIREMENTS

The ZDHC inventory template contains further columns which deal with the identification, classification of inherent hazards characteristic as well as listing of chemicals of priority concern (for example ZDHC Manufacturer Restricted Substances List – ZDHC MRSL). For further information on the identification, classification of inherent hazards characteristic as well as listing of chemicals of priority concern, please refer to sections 3.1. and 3.2 of the tool kit.

Product name	Chemical name	…	SDS on file	Hazard class	R-phrases/ H-statements	11 ZDHC Priority Chemical Class	On factory/ ZDHC MRSL	On brand's RLS	Shelf life	……
Hydrochloric acid (37%)	Hydrochloric acid	…	Yes	Class 8	H290 H314 H335	N/A	No	No	mm.yy	
Glauber's salt	Sodium sulphate	…	Yes	Non-hazardous	H317	N/A	No	No	mm.yy	
		…								

2.2. PREPARE CHEMICAL INVENTORY

Explanatory note:

R-phrases or **risk phrases** refers to a list of abbreviated descriptions of hazardous characteristics associated with chemicals as originally defined in Annex III of European Union Directive 67/548/EEC. These risk phrases were widely used internationally, not just in Europe, and have been replace with a more harmonized system under the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) as an internationally agreed-upon system, created by the United Nations (see H-statements)

H-statements or **hazard statements/codes** refer to a list of abbreviated descriptions of hazardous characteristics associated with chemicals as defined under the Globally Harmonized System of Classification and Labelling of Chemicals (GHS). You should be able to find the H-statement(s) for chemicals used in your company on the chemical container/package and/or in the safety data sheet. If not available, inquire with your chemical supplier or check in one of the internet based chemical data bases against the CAS number (e.g. GESTIS, see link below).

What to do when…	…you come across chemical substances that you cannot identify immediately. Assign a temporary name (e.g. Unknown 1, Unknown 2) to these substances in your inventory table. Write this temporarily assigned name on a tag, and attach the tag to the chemical container in the factory to allow for follow-up at a later stage. Be sure to specify in the map the physical location of these substances within the factory. Quite often somebody in your company may know the "unknown" chemical. If not, you may have to analyse the chemical, so as to find out how the chemical needs to be disposed of, if it is not of further use to your company

USEFUL LINKS FOR COMPLETING STEP 2, TASK 2.2

Click on the green document icons to get further information

For further information and use		
Some useful links		
	ZDHC Inventory template	Sample inventory outline as per the ZDHC Chemical Management System Guidance manual
	ZDHC Priority Chemicals	List of chemical substances subject to a usage ban for the apparel and footwear industry as per Zero Discharge of Hazardous Substances (ZDHC). www.roadmaptozero.com/programme/manufacturing-restricted-substances-list-mrsl-conformity-guidance/
	Bluesign Substance List	List of chemicals specifying the limits for chemical substances in articles as well as defining usage bans for chemical substances in manufacturing of articles.as per BlueSign. www.bluesign.com/industry/infocenter/downloads
	GESTIS database	Link to information system on hazardous substances of the German Social Accident Insurance, containing information for the safe handling of hazardous substances and other chemical substances at work. http://www.dguv.de/ifa/gestis/gestis-stoffdatenbank/index-2.jsp

2.3. PREPARE NON-PRODUCT OUTPUT/WASTE INVENTORY

Chemical process flow charts and eco-maps (see 2.1) document and account for materials (chemicals) entering and leaving a system. The chemical inventory (see 2.2) provides a comprehensive list of the chemicals entering your production. Not all of these chemical inputs end up in the final product, for example for technical/production process reason, fabrics or leather will absorb only part of a dye stuff or tanning agent. These remaining chemicals (non-product outputs - NPO) leave the system as discharge into the air, water or residuals in solid or liquid form.

According to ZDHC CMS 2.1.4.4, factories are expected to plan how and where to safely store such chemical waste as well as to document where it is generated and how it will be disposed.

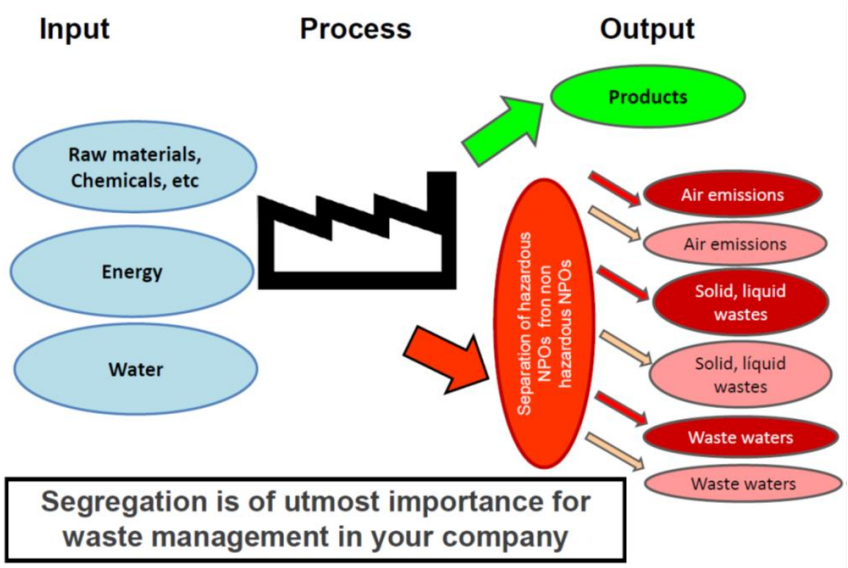


Figure 1 – Non-product output flows, Source: GIZ CHS

Practical tips:

Methodologies such as mass or material balancing which are used widely in engineering and environmental analyses, help detailing and quantifying the input, output and non-product outputs flows as well as allow putting a cost-tags to the same.

2.3. PREPARE NON-PRODUCT OUTPUT/WASTE INVENTORY

The information/data gathered during the process flow analysis and mass/material balancing will provide key inputs in compiling an inventory of the non-product outputs in your factory and developing a (chemical) waste management plan and/or decide on measures to reduce non-product outputs, for example use of good basic manufacturing practices, process optimization, increase in chemical uptakes. The remaining non-product outputs need to be managed and disposed. The on-site or off-site treatment processes themselves can produce chemical containing waste, for example treatment sludge, or used air filters.

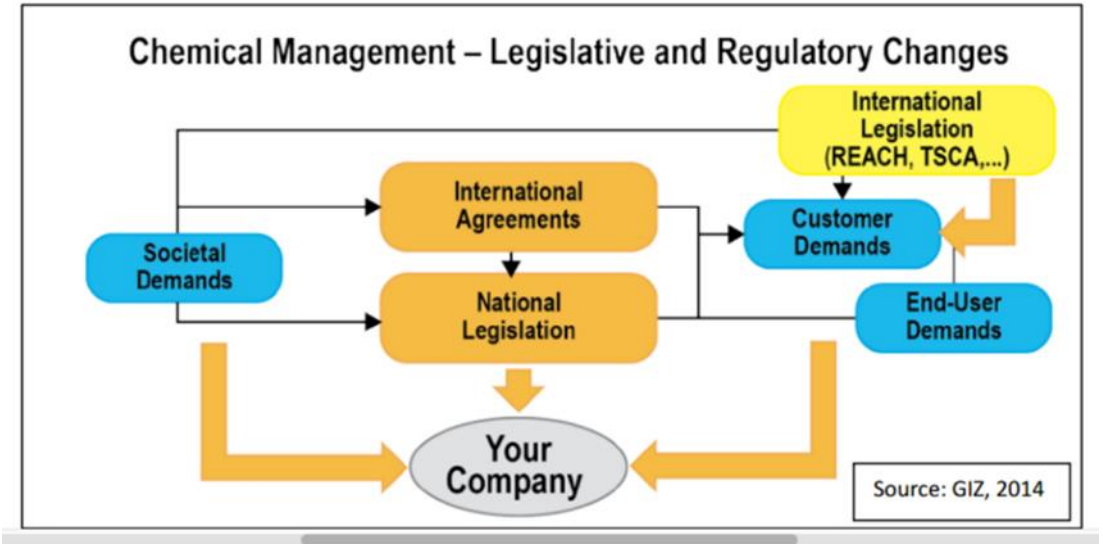
Example - Waste inventory outline

Waste Name	Category / Type	Source Process	Storage Area	Yearly Quantity	Associated Hazards	Disposal Method (actual/recommended	Waste Disposal Vendor Address	License Number	License Validity Time

To download this waste inventory template, click here

2.4. IDENTIFY AND DOCUMENT REGULATORY REQUIREMENT

Apart from the national legislation in the country of your company`s residence, you may also be obliged to comply with or be at least aware of regulations outside your country, such as with those of your export markets (for example, the European chemical regulations REACH). Legal requirements include, but are not limited to national requirements, state and local requirements, permit conditions but also other requirements such as industry codes of practice, pledges or commitments made voluntarily by your company or customers` requirements (e.g. supplier code of conducts).



Framework of legal and other requirements, Source: GIZ PSES, Bangladesh

- As per the ZDHC Chemical Management System Guidance Manual, companies are expected to establish and maintain a Standard Operating Procedures (SOP) for monitoring regulatory requirements and maintain an up-to-date inventory of legal requirements permits.

2.4. IDENTIFY AND DOCUMENT REGULATORY REQUIREMENT

HOW TO IDENTIFY AND MONITOR REGULATIONS AND PERMITS

☐ Identify and state all applicable jurisdictions, regulations and permits necessary to operate (city, state and country level). Possible sources are commercial services (with updates offered on-line, on CD-ROM, or in paper form), regulatory agencies (federal, state and local), trade groups / associations, the Internet (see REACH www.echa.org), seminars and courses; newsletters / magazines, consultants and attorneys; your customers, and chemical suppliers.

☐ Assign regulatory identification to a person or a team (initial and ongoing)

☐ Describe communication processes in case of regulatory changes and/or when permits expire, operational limits change etc.

2.4. IDENTIFY AND DOCUMENT REGULATORY REQUIREMENT

HOW TO ESTABLISH AND MAINTAIN A REGULATORY INVENTORY

This is not a “one time” activity. Because legal and other requirements change over time, your procedure should include a means to ensure that you are working with up-to-date information.

Example: Legal inventory format

No.	Title	Descriptions	Applicable to		Area of Applicability	Licenses / Compliance Records Required	Re-viewed
			Company	Contractor / Supplier			
xxx	*Environment Conservation Act 1996* (section xx)	Provides for the control of air pollution from stationary sources and motor vehicles. Also enables promulgation of regulations	✓	✓	Air emissions from plant,….	xxx	
xxx	Environment Conservation Act 1996 (section xx)	Provides for the control of water pollution, including reference to specific discharge standards	✓		Discharge of waste water from production and other sources in the company	xxx	
xxx	Sludge ordinance	Provides for the control of management and disposal of treatment sludge	✓		Disposal of treatment sludge from ETP	xxx	

USEFUL LINKS FOR COMPLETING STEP 2, TASK 2.4

For further information and use ***Some useful links***		
	Sample procedure	Model outline of a procedure
	Regulatory inventory template	Template for recording and monitoring the legal and other requirements your company subscribes to.

Click on the green document icons to get further information

STEP 3

IDENTIFYING AND ASSESSING CHEMICAL HAZARDS

Not all of the chemical substances which you have identified in your inventory list have to be hazardous. Hazardous chemicals are defined as chemicals which have an inherent property to cause harm either to humans or the environment and/or cause damage through fire, explosion or through corrosiveness or toxicity, with local or global effects. These usually require special procedures for safe handling and disposal.

Step 3 deals with the question of how to systematically identify hazardous chemicals and their hazard properties as well as to categorise these in form of hazard bands.

Tasks/Elements

3.1. Review your hazard information sources

3.2. Identify hazards and determine hazard bands of chemical

3.3. Identify and classify hazardous chemical waste

ZDHC CMS References

ZDHC CMS 2.4 Chemical Risk Assessment

ZDHC CMS 2.4.2 Environmental - Process/Plan for Reducing Environmental Impacts

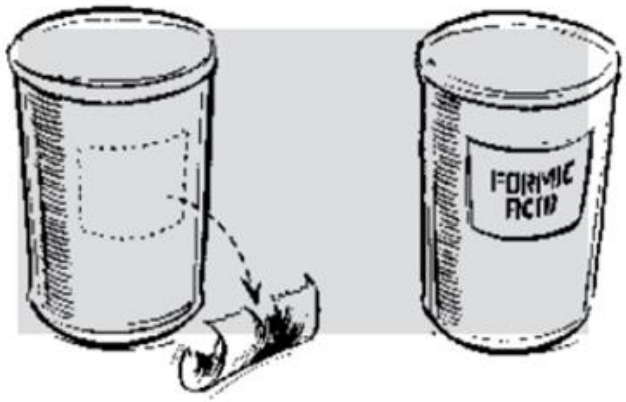
ZDHC CMS 2.4.3 Health and Safety - …identifying and controlling the potential health and safety impact from chemicals stored, used and discarded at your site.

ZDHC CMS 3.5.2 Safety Data Sheet Management

3.1. REVIEW YOUR HAZARD INFORMATION SOURCES

Data on hazard/safety of the chemical represents key information for proceeding with the assessment and management of chemical risks; do not proceed unless you have obtained and documented this information. Getting such reliable information may sometimes be very tricky, but there are several sources of information. Hazard and risk information can be obtained from container labels, safety data sheets, the internet, staff chemists and chemical suppliers.

As per international practice and recommendation, chemical containers and packaging should allow for clear identification of chemical substances. The manufacturer/supplier should also indicate whether the substance you use may be hazardous and may pose a risk, if exposed to humans or the environment or accidentally released. For these purpose, different internationally standardized labels, markings, symbols, risk-phrases or hazard statements are commonly used by chemical manufacturers and suppliers.



- In line with the ZDHC Chemical Management System guidelines, your organization is expected to document and implement procedures to ensure that the identification of raw chemicals includes appropriate labelling, supplier name, receipt tracking information, matching supplier documentation and quantity tracking.

3.1. REVIEW YOUR HAZARD INFORMATION SOURCES

STANDARD CHEMICAL HAZARD PICTOGRAMS

In view of the large variety of labels and several discrepancies in the categorization of chemical substances, the United Nations initiated steps in 1992 to harmonize the labelling and classification systems into an internationally agreed-upon system, the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

Since 2015 an increasing number of countries has been adopting GHS.

- ☐ Which pictograms do you come across in your company?
- ☐ Does your company already use GHS conform hazard pictograms?

3.1. REVIEW YOUR HAZARD INFORMATION SOURCES

CHEMICAL HAZARD PICTOGRAMS USED DURING TRANSPORT OF CHEMICALS

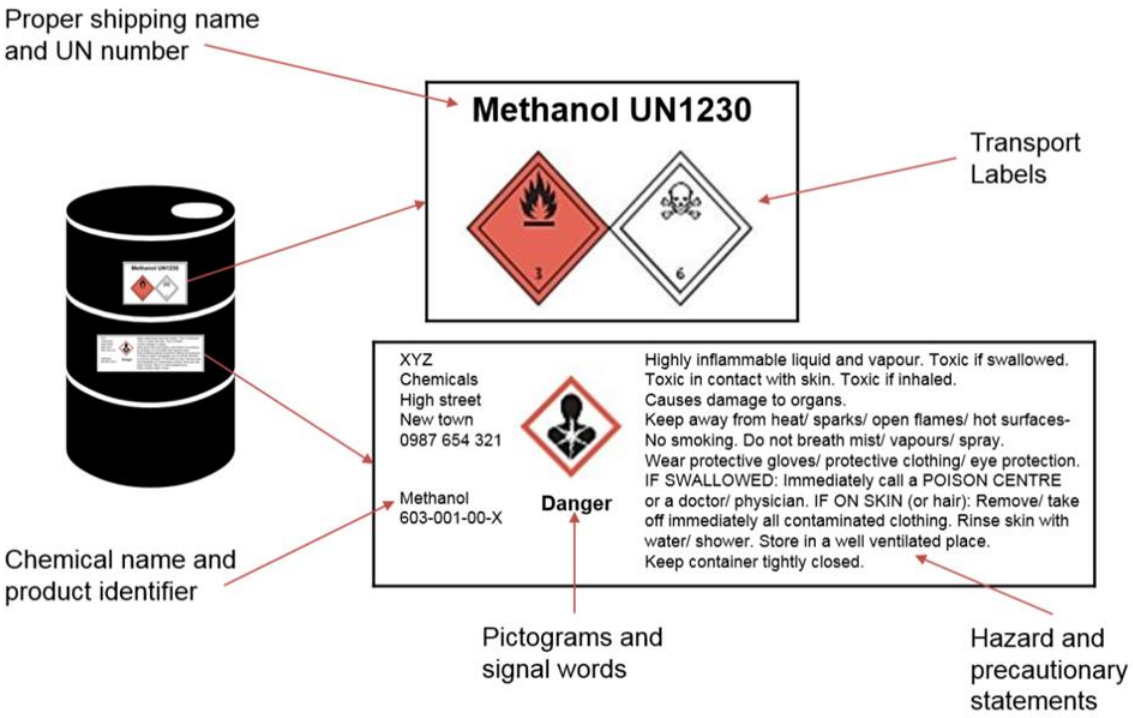
In addition to the GHS type pictograms, symbols as defined under the United Nations Committee for the Transport of Dangerous Goods are in use for purpose of identifying hazard properties of chemicals during transport.

☐ Are the chemical containers you receive in your company labelled with any pictograms?

3.1. REVIEW YOUR HAZARD INFORMATION SOURCES

VERIFY AVAILABILITY AND CONTENT OF CHEMICAL CONTAINER/PACKAGE LABELS

In line with the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) requirements and international good practices, check whether the labels on the chemical containers and packages you receive and use in your organization contain the elements as shown in the graphic.



Minimum requirements of chemical label, Source: UNIDO IAMC Toolkit, 2015

3.1. REVIEW YOUR HAZARD INFORMATION SOURCES

VERIFY AVAILABILITY AND CONTENT OF CHEMICAL SAFETY DATA SHEETS

Material Safety Data Sheets (MSDS) or Safety Data Sheets (SDS) are the key source of information on chemical substances and mixtures in the context of the chemical management in your organization.

Their content enable you to understand the hazards association with the substance or mixture, guide you on how to correctly handle and store, what necessary measures to take for the protection of human health and safety at the workplace and society and protection of the environment, on how to respond in case of emergencies as well as how to dispose it at the end.

The Globally Harmonized System of Classification and Labelling of Chemicals (GHS) does not only harmonise the hazard pictograms, labelling and classification of chemicals but also outlines the structure and contents of safety data sheets.

3.1. REVIEW YOUR HAZARD INFORMATION SOURCES

VERIFY AVAILABILITY AND CONTENT OF CHEMICAL SAFETY DATA SHEETS

As per GHS, the safety data sheet should include (at least) the following 16 standard sections:

SECTION 1: Identification of the substance/mixture and of the company	SECTION 9: Physical and chemical properties
SECTION 2: Hazards identification	SECTION 10: Stability and reactivity
SECTION 3: Composition/information on ingredients	SECTION 11: Toxicological information
SECTION 4: First aid measures	SECTION 12: Ecological information
SECTION 5: Firefighting measures	SECTION 13: Disposal considerations
SECTION 6: Accidental release measure	SECTION 14: Transport information
SECTION 7: Handling and storage	SECTION 15: Regulatory information
SECTION 8: Exposure controls/personal protection	SECTION 16: Other information

3.1. REVIEW YOUR HAZARD INFORMATION SOURCES

VERIFY AVAILABILITY AND CONTENT OF CHEMICAL SAFETY DATA SHEETS

Since your chemical suppliers are expected to provide you with up-to-date safety date sheets in line with GHS, consider including this requirement into your chemical purchase requisitions. The ZDHC Chemical Management System Guidelines suggests that those chemical suppliers should be given preference that provide you with an SDS which are in the local language and contain all the relevant information according to the GHS.

Practical tips

In case you face difficulties with obtaining safety data sheets, you can also refer to various internet resources, such as the GESTIS database (www.dguv.de/ifa/gestis/gestis-stoffdatenbank/index-2.jsp).

Check in your company

- ☐ Are all your chemical containers labelled with GHS symbols?
- ☐ Do the chemical container labels contain the minimum information as per GHS?
- ☐ Are all the up-to-date (not older than 3 years) safety data sheet for your chemicals available?
- ☐ Are these made available in the local language?

USEFUL LINKS FOR COMPLETING STEP 3, TASK 3.1

For further information and use ***Some useful links***		
	Safety data sheet checklist	Checklist to verify the quality of safety data sheets available or provided by your chemical suppliers.
	H-statement	List to check GHS hazard statement codes and their meaning

Click on the green document icons to get further information

3.2. IDENTIFY HAZARDS AND DETERMINE HAZARD BANDS OF CHEMICAL

At this point you start categorising the chemicals as being hazardous and non-hazardous by using information sources such as labels, safety data sheets, information from chemical supplier or other sources. As part of this process, take a closer look at the different categories and levels of hazards associated with the chemical substances and get further information on how these chemicals may affect health, safety and/or the environment.

The standard classification systems of hazards under the Globally Harmonized System of Classification and Labelling of Chemicals (GHS) distinguishes between three main groups of hazards: (1) physical, (2) health and environmental hazards. These groups are further separated into classes of hazards; for example, for physical (P) hazards there are 16 classes of hazards, for health (H) hazards 9 classes and for environmental (E) hazards two class. In turn, each hazard class is further divided into hazard categories.

- As per ZDHC Chemical Management System Guidelines, your organization is expected to establish a standard operating procedure to classify chemicals by their hazards and categorize hazardous chemicals by their GHS classification as shown on their label and/or in their safety data sheets.

Practical tip:

You can retrieve information on the respective hazard classes and categories from your GHS conform safety data sheets (usually from section 2 - hazard identification or section 15 - regulatory information).

3.2. IDENTIFY HAZARDS AND DETERMINE HAZARD BANDS OF CHEMICAL

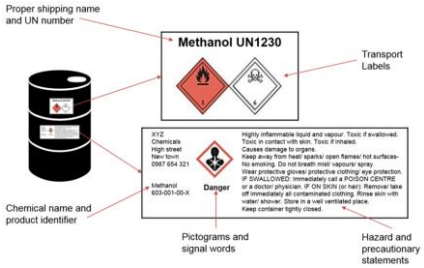
CLASSIFICATION OF CHEMICAL HAZARDS AS PER GHS SYSTEM

Physical (P)		Health (H)	Environment (E)
1. Explosives	11. Self-heating substances and mixtures	1. Acute toxicity	1. Hazardous to aquatic environment
2. Flammable gases	12. Substances and mixtures which, in contact with water, emit flammable gases	2. Skin corrosion/irritation	2. Hazardous to ozone layer
3. Aerosols	13. Oxidising liquids	3. Serious eye damage/irritation	3. Global warming effect
4. Oxidizing gases	14. Oxidising solids	4. Respiratory or skin sensitization	
5. Gases under pressure	15. Organic peroxides	5. Germ cell mutagenicity	
6. Flammable liquids	16. Corrosive to metals	6. Carcinogenicity	
7. Flammable solids		7. Reproductive toxicity	
8. Self-reactive substances and mixtures		8. Specific target organ toxicity (single exposure)	
9. Pyrophoric liquids		9. Specific target organ toxicity (repeated exposure)	

3.2. IDENTIFY HAZARDS AND DETERMINE HAZARD BANDS OF CHEMICAL

IDENTIFY HAZARDS USING HAZARD-STATEMENTS (H-STATEMENTS)

For the immediate identification of the respective hazards of a specific substance, you can refer to the hazard statements (short: H-statements) which should be displayed on the label on the chemical container /packaging as well as listed in the respective safety data sheet. These hazard statements usually appear in form of three-digit codes, preceded by the capital letter “H”.



Hazard Type Group	H-statement Code (basic)	Existing codes
Physical hazard (P)	H 2xx	H200 - H290
Health hazard (H)	H 3xx	H300 - H373
Environmental Hazard (E)	H 4xx	H400 - H413

Examples

- H224 – Extremely flammable liquid and vapour
- H331 – Toxic if inhaled
- H411 – Toxic to aquatic life with long lasting effect

3.2. IDENTIFY HAZARDS AND DETERMINE HAZARD BANDS OF CHEMICAL

RELATE HAZARD STATEMENTS TO GHS HAZARD CLASSES

The Globally Harmonized System of Classification and Labelling of Chemicals (GHS) documentation in Annex 3, Section 1, Codification of Hazard Statements contains tables which allow you to relate the H-statements to hazard classes and categories. Once you identify the hazard class and category you can update the information in the respective column of your chemical inventory (see 2.2 chemical inventory). The GHS reference materials also contains detailed definitions for the criteria of each hazard class and category.

Code	Hazard type group	Hazard statement	Hazard class (as per GHS)	Category
H224	Physical	Extremely flammable liquid and vapour	2.6 - Flammable liquid	1
H331	Health	Toxic if inhaled	3.1 - Acute toxicity	3
H411	Environment	Toxic to aquatic life with long lasting effects	4.1 - Hazardous to aquatic environment (long-term)	2

3.2. IDENTIFY HAZARDS AND DETERMINE HAZARD BANDS OF CHEMICAL

RANK CHEMICALS BY HAZARD LEVELS

With the help of a simple tool, you can further categorise the chemicals by their hazard severity levels using the H-statements. Though this is not specifically required as per the ZDHC Chemical Management System Guidelines, it will help you the decide on which chemicals you may want to focus first, such as for possible substitution or other interventions.

Using hazard banding…

As a first step, you identify the location of the specific H-statement in a pre-set table. Thereafter, you can assign the chemical substance to a specific hazard band representing its hazard level. While this method has some limitation, hazard banding forms an integral part of simplified risk assessment tools such as “Control Banding”. The Control banding approach was originally developed by the International Labor Organization (ILO) and has been adapted and integrated into risk assessment tools such as Control of Substances Hazardous to Health (COSHH) essential by Health and Safety Executive (HSE) in Great Britain.

3.2. IDENTIFY HAZARDS AND DETERMINE HAZARD BANDS OF CHEMICAL

HOW TO USE HAZARD BANDING

The German Social Accident Insurance (IFA) has developed and published the so-called IFA "Column model", which is based on the same principle, which allows you to prioritize or assess the potential/need of which chemical substances to substitute. http://www.dguv.de/medien/ifa/en/pra/ghs_spaltenmodell/spaltenmodell_2017_en.pdf

Example: Finding health hazard band for Acetone

STEP 1 - FIND H-STATEMENTS IN SAFETY DATA SHEET

… H319 …

STEP 2 - LOCATE H-STATEMENT IN IFA COLUMN MODEL OR SIMILAR HAZARD BAND TABLE

STEP 3 - CHECK RISK/HAZARD BAND LEVEL

=> HEALTH HAZARD LEVEL LOW

	• Substances/mixtures with corrosive effect on respiratory organs (**EUH071**) • Nontoxic gases that can cause suffocation by displacing air (e.g. nitrogen)	• Substances/mixtures that can harm babies via their mothers' milk (**H362**)	
low	• Skin-irritant substances/mixtures (**H315**) • Eye-irritant substances/mixtures (**H319**) • Skin damage when working in moisture • Substances/mixtures with a risk of aspiration (**H304**) • Skin-damaging substances/ mixtures (**EUH066**) • Substances/mixtures with specific target organ toxicity (single exposure), Cat. 3: irritation of the respiratory organs (**H335**) • Substances/mixtures with specific target organ toxicity (single exposure), Cat. 3: drowsiness, dizziness (**H336**)	• Substances chronically harmful in other ways (no H-phrase, but still a hazardous substance!)	• Substances/mixt chronically hazar the aquatic envir Cat. 4 (**H413**) • Substances/mixt German Water Ha **WGK 1**
negligible	• Safe substances on the basis of experience (e.g. water, paraffin and the like)		• Substances/mixt hazardous to thes environment (**NWG**, former **WO**

3.2. IDENTIFY HAZARDS AND DETERMINE HAZARD BANDS OF CHEMICAL

USING THE INFORMATION ON CLASSIFICATION AND HAZARD BANDS

Once you have updated your chemical inventory table (see 2.2) with the information on hazard classes/categories or hazard band, you can conduct a first analysis of your inventory table answering questions such as

- ☐ What (common) hazards are (most) prevalent and in which sections of my/our organization?
- ☐ Which ones are the most hazardous chemicals?
- ☐ In which section are the most hazardous chemicals used?
- ☐ Is the hazard information complete (e.g. are there any missing labels/SDS)?
- ☐ Are any banned/restricted substances in use?
- ☐ In which areas may we focus our efforts for identifying any alternative/ less hazardous substances?

When planning corrective action, substances categorised in high hazard bands should be of priority to you.

USEFUL LINKS FOR COMPLETING STEP 3, TASK 3.2

For further information and use ***Some useful links***		
	IFA Column Model	Tool to categorize chemicals by hazard bands (hazard level) referring to hazard (H)-statements.
	H-statements	List to check GHS hazard statement codes and their meaning

Click on the green document icons to get further information

3.3. IDENTIFYING AND CLASSIFYING HAZARDOUS WASTE

Not all chemicals applied in the production process end up in the final products but may be discharged in gaseous, liquid or solid form (refer to chemical process flow charts and eco-maps in 2.1). In addition, you will have to manage chemical related waste such as empty chemical containers with or without residual chemicals, replaced air filters, treatment sludge from your waste water treatment plant.

At the end, dealing with these chemical waste forms an integral part of your environmental/chemical management system. In line with international good waste management practices, a classification of the chemical waste is recommended.

In this section, you will mainly focus on the solid chemical waste (not including treatment sludge), referring to the waste inventory concept as presented in section 2.3.

- As per ZDHC Chemical Management System Guidelines, your company is expected to prepare and implement a waste action plan, including a procedure for proper waste identification, collection, handling, storing and disposal. As part of these efforts, a standard labelling procedure for waste, using colorfast, permanent labels is required.

- The waste water guidelines under the ZDHC Program prescribe specific discharge limits for waste water and sludge with regard threshold limits of certain pollution parameters and of the ZDHC regulated chemicals. To learn more about these, refer to the respective publications on the website of ZDHC www.roadmaptozero.com .

3.3. IDENTIFYING AND CLASSIFYING HAZARDOUS WASTE

CATEGORIZE YOUR HAZARDOUS AND NON-HAZARDOUS WASTE

To distinguish hazardous from non-hazardous waste, regulators of most countries have adopted generic hazardous waste lists comprising common hazardous waste types that are known to exceed minimum hazardous characteristics thresholds. Waste types specified in these lists are defined as hazardous.

Complementary to these hazardous waste lists, regulators have defined a series of hazardous characteristics that render wastes hazardous (when exhibiting these characteristics). US-EPA defines four hazard characteristics (ignitibility / flammability, corrosiveness, reactivity and toxicity), whereas the EU, using a more detailed approach, defines 15 hazard characteristics (H1-H15). The Basel Convention defines 13 hazard characteristics, very similar to those of the EU.

Basic questions to ask:

☐ Which substances are contained in the waste (hazardous/non-hazardous)?

☐ What are the hazardous properties of those substances?

☐ What are the threshold concentrations of those substances for making a waste hazardous?

Start answering these questions by consulting your corresponding chemical safety data sheet(s).

Code	Designation	Note
H 1	**Explosive**	Substances and preparations which may explode under the effect of flame or which are more sensitive to shocks or friction than dinitrobenzene.
H 2	**Oxidizing**	Substances and preparations which exhibit highly exothermic reactions when in contact with other substances, particularly flammable substances.
H 3A	**Highly Flammable**	• Liquid substances (including extremely flammable liquids) and preparations having a flashpoint of below 21°C, or • Substances and preparations which may become hot and finally catch fire in contact with air at ambient temperature without any application of energy, or • Solid substances and preparations which may readily catch fire after brief contact with a source of ignition and which continue to burn or to be consumed after removal of the source of ignition, or • Gaseous substances and preparations which are flammable in air at normal pressure, or • Substances and preparations which, in contact with water or damp air, evolve highly flammable gases in dangerous quantities.
H 3B	**Flammable**	Liquid substances and preparations having a flashpoint equal to or greater than 21°C and less than or equal to 55°C.
H 4	**Irritant**	Non-corrosive substances and preparations which, through immediate, prolonged or repeated contact with the skin or mucous membrane, can cause inflammation.
H 5	**Harmful**	Substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may involve limited health risks.
H 6	**Toxic**	Substances and preparations (including very toxic substances and preparations) which, if they are inhaled or ingested or if they penetrate the skin, may involve serious, acute or chronic health risks and even death.
H 7	**Carcinogenic**	Substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce cancer or increase its incidence.
H 8	**Corrosive**	Substances and preparations which may destroy living tissue on contact.
H 9	**Infectious**	Substances containing viable micro-organisms or their toxins which are known or reliably believed to cause disease in man or other living organisms.
H 10	**Toxic for reproduction**	Substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may produce or increase the incidence of non-heritable adverse effects in the progeny and/or of male or female reproductive functions or capacity.
H 11	**Mutagenic**	Substances and preparations which, if they are inhaled or ingested or if they penetrate the skin, may induce hereditary genetic defects or increase their incidence.
H 12	-	Substances and preparations which release toxic or very toxic gases in contact with water, air or an acid.
H 13	**Sensitizing**	Substances and preparations which, if they are inhaled or if they penetrate the skin, are capable of eliciting a reaction of hyper-sensitization such that on further exposure to the substance or preparation, characteristic adverse effects are produced.
H 14	**Eco toxic**	Substances and preparations which present or may present immediate or delayed risks for one or more sectors of the environment.
H 15	-	Substances and preparations capable by any means, after disposal, of yielding another substance, e.g. a leachate, which possesses any of the characteristics listed above.

Criteria that render wastes hazardous according to European Waste Regulation

3.3. IDENTIFYING AND CLASSIFYING HAZARDOUS WASTE

CATEGORIZE YOUR HAZARDOUS AND NON-HAZARDOUS WASTE - EXAMPLE

Waste containing hydrogen peroxide as identified in waste inventory (see section 2.3)

Waste Name	Category / Type	Source Process	Storage Area	Yearly Quantity	Associated Hazards	Disposal Method (actual/recommended	Waste Disposal Vendor Address	License Number	License Validity Time
Container with residual hydrogen peroxide	Solid and liquid	Bleaching							

In the example of the hydrogen peroxide residuals in the container, the safety data sheet will indicate following hazardous properties:

- H271 (May cause fire or explosion; strong oxidiser), H302 (Harmful if swallowed), H314 (Causes severe skin burns and eye damage), H332 (Harmful if inhaled), H335: May cause respiratory irritation, H412: Harmful to aquatic life with long lasting effects.
- When comparing this information from the safety data sheet with the criteria in the European Waste Regulation, the waste identified in bleaching meets several of these criteria (for example H1, H2, H4, H5, H8, H14) hence rendering this waste as hazardous. The same chemical container, once thoroughly rinsed with the diluted hydrogen peroxide and wash water discharged to the waste water treatment plant, will not constitute hazardous waste.
- Consult the safety date sheet on the recommended disposal options.

3.3. IDENTIFYING AND CLASSIFYING HAZARDOUS WASTE

LABELLING OF WASTE CONTAINERS

As in case of containers with hazardous chemicals, all waste containers with hazardous waste need to be clearly identifiable as well.

Recommended elements of labels on waste containers

- ☐ warning “hazardous waste”
- ☐ description of contents, also in layman’s terms
- ☐ indication of hazard properties – e.g. “flammable”, “corrosive”, “toxic”, “explosive” - similar to labels and pictograms used for hazardous chemicals
- ☐ department/section where the waste has been generated
- ☐ name and telephone number of the employee responsible for internal hazardous waste management
- ☐ date of filling of the container

3.3. IDENTIFYING AND CLASSIFYING HAZARDOUS WASTE

ASSIGN HAZARD CLASSIFICATION CODES TO YOUR WASTE

When classifying waste, you can follow a logical assessment flow and use internationally available waste lists to clearly classify your waste. You may use lists which exist in your country or refer to one the common internationally used waste lists such as the Y-code list (for the transboundary HW movement according to the Basle Convention), the US lists (F, K, P, U) or the European waste list (EWL) or the OECD amber list.

Using these lists of standard classification will help you to connect with an existing national or local waste management system at a later stage when you are planning on sending your hazardous waste on for further treatment or final disposal off-site. With a good waste list at hand, it should be possible to refer to the list and to check if the waste under consideration is listed as hazardous or not.

Use the link on the right side for further guidance on the classification of your waste.

Guideline for classification of your waste based on the European List of Waste (Commission Decision 2000/532/EC) and Annex III to Directive 2008/98/EC.
http://ec.europa.eu/environment/waste/framework/list.htm

STEP 4

IDENTIFYING AND ASSESSING RISKS AND CONTROL GAPS

Once you have identified the process flows, taken inventory of your chemicals and wastes and gained a better understanding of the hazard properties associated with the same (as explained in steps 2 and 3), you can move forward to the identification and assessment of their risks and possible control gaps.

Tasks/Elements

4.1. Assess and map chemical risks

4.2. Identify chemicals and processes of concerns

ZDHC CMS References

ZDHC CMS 2.4 Chemical Risk Assessment

- Hazard and risk assessment (inventory, procedure)
- Environmental (procedure, waste plan)
- Health and safety (procedure, JHA/JSA/THA

ZDHC CMS 2.5 Chemicals and Processes of Concern

- Identify gaps and losses in current processes (e.g. hotspots)
- RSL and MRSL process (e.g. process for verifying compliance, update and maintenance, integration of suppliers)

ZDHC CMS, Appendix D Risk Assessment Template

4.1. ASSESS AND MAP CHEMICAL RISKS

The hazard analysis and classification (see section 3.2) provides answer on what intrinsic hazard properties may be associated with the chemical substances used or present in your organization. The question whether and to which extent the use of this chemical will result in actual negative impact, harm to health, environment and/or damage to property is answered with the help of a risk assessment.

For example:

- The presence of a hazardous chemical with the potential of adversely affecting the lung functioning may pose only a low risk as long as it is store in its original container. The moment the same chemical is handled by workers in the workplace the probability increases that the worker may get exposed and adversely affected.
- Similarly, the use of an aqua toxic substance may pose a low risk as long as it used in a closed system, but there may be an adverse effect, if the chemicals leaks into a waterbody or is discharged with waste water without proper treatment.

Possible ways of getting exposed to chemical substances

- **Inhalation of airborne chemicals (gases, vapours or airborne particulates (dust, smokes, aerosols)**
- **Skin contact and absorption through skin and eyes in gaseous, liquid or solid form**
- **Ingestion of chemicals in liquid and solid form**
- **Injections**
- **Radiation.**

4.1. ASSESS AND MAP CHEMICAL RISKS

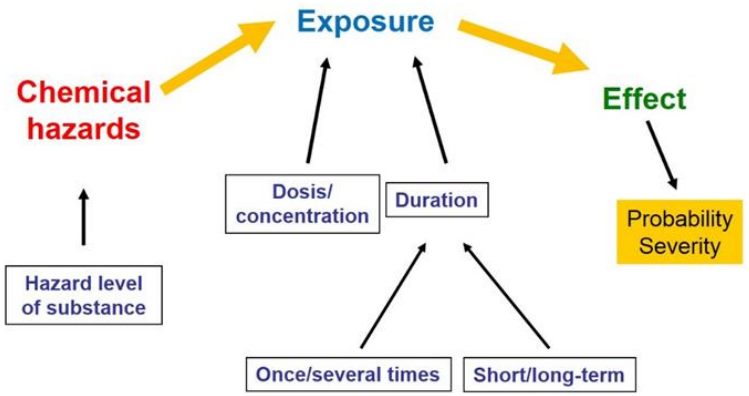
CHEMICAL EXPOSURE IN THE WORKPLACE

The most common route of workplace exposure is by inhalation, followed by skin and eye/contact. Whether this exposure in turn may result in an adverse health effect, depends on a number of factors:

- ☐ Inherent hazard level of the chemical substance (e.g. high, low)
- ☐ Quantity/concentration of the chemical substance exposed to
- ☐ Length of exposure (short-term, long-term. e.g. minutes, hours?)
- ☐ Frequency of exposure (one time, repeatedly)

The risk assessment takes into consideration these factors as well as the existing controls in place to establish the probability of potential adverse effects. The safety data sheets usually list common exposure limits for short-term and long-term/repeated exposure (e.g. per shift).

Relationship between hazard, exposure and effect



For example:

The contact with a highly corrosive chemical substance may result in an immediate severe burn to the exposed skin or eye; a carcinogenic substance may lead to lung cancer, when inhaled repeatedly over a long-period of time.

4.1. ASSESS AND MAP CHEMICAL RISKS

HOW TO ASSESS THE RISKS

The process flow chart, eco-map as well as the chemical inventory with the results of the hazard analysis will help you to identify and pin-point those areas in your organization in which such exposure or release to the environment might take place as well as to prioritize in which areas to look first.

For assessing the risk as such, take a closer look at the processes and tasks. Also seek further information from your workers and their health and safety representatives to understand the actual situation at hand. This will help you later on to select the most suitable and effective control measures.

- As per the ZDHC CMS, your organisations is expected to establish, document and implement a process for assessing the hazards and risks associated with chemicals identified in the chemical inventory and update those inventories annually. Annex D of the ZDHC CMS Guidance Manual provides a risk assessment template and further guidelines on how to use the same.

4.1. ASSESS AND MAP CHEMICAL RISKS

HOW TO ASSESS THE RISKS

Example of questions to ask..

- ☐ How are the specific tasks or processes actually carried out in the workplace (for example, mixing, dosing, spraying, printing,…). By observing and consulting workers you can find out if they are not adhering strictly to standard procedures or if procedures are not adequately providing protection to workers (not using prescribed personal protective equipment).
- ☐ Which quantities of the chemicals are being used? Use of larger quantities could result in greater potential for exposure
- ☐ Which risk controls are in place and are they effective? (For example, a ventilation system may be available, but is not used or poorly designed)
- ☐ What is the level of qualification/competence of the persons handling these processes and tasks?
- ☐ How many number of persons are/ay be exposed at the same time)
- ☐ Which work activities involve routine and frequent exposure to hazardous chemicals (for example, daily exposure, including during end of shift cleaning) and who are the people performing these activities?
- ☐ What happens when non-routine work, production of one-off items or isolated batches, trials, maintenance or repair operations are performed?
- ☐ What happens when there are changes to work practices in events such as cleaning, breakdowns, changes in volume of production, adverse weather conditions?
- ☐ Are there differences between workers within a group? Anyone whose work habits or personal hygiene (for example, washing before eating, drinking or smoking) are significantly different should be considered separately.…
- ☐ …

4.1. ASSESS AND MAP CHEMICAL RISKS

ASSESS THE RISKS - COMMON APPROACHES

Your risk assessment approach may involve the use of a risk matrix (see example below) to establish the risk factor or rating.

Frequency 5	5/1	5/2	5/3	5/4	5/5
Frequency 4	4/1	4/2	4/3	4/4	4/5
Frequency 3	3/1	3/2	3/3	3/4	3/5
Frequency 2	2/1	2/2	2/3	2/4	2/5
Frequency 1	1/1	1/2	1/3	1/4	1/5
	Severity 1	**Severity 2**	**Severity 3**	**Severity 4**	**Severity 5**

Area where risks are critical and required monitoring/ control

Area where risks are considered unacceptable

For each task/process involving hazardous chemicals you

1. Describe the situation/process/task
2. Determine the number of persons involved (e.g. contractor, supervisors, worker)
3. Identify and categorise severity - as part of your risk assessment procedure you will have to separately define the severity categories (see example of severity rating below)
4. Estimate probability/ likelihood – similar to the severity categories, you will also have to define criteria for the probability/likelihood.
5. Assign risk factors
6. Verify the controls in place
7. Decide whether further action is required and assign priority

Source: UNEP Responsible Production Toolkit

4.1. ASSESS AND MAP CHEMICAL RISKS

ASSESS THE RISKS - COMMON APPROACHES

Example for severity ratings (Source: UNEP Responsible Production)

Class	Category	Life and Health		Impact on			Cost impact (materials loss, damage to production and community infrastructure)	Company image, fines, loss of orders
		Workers	Community	Land use, agri-culture/ fisheries	Water resources	Air		
1	Unimportant, negligible	Temporary slight discomfort	Temporary slight discomfort	No contamination, localised effects)			< 0.5 Million US$	Small disturbance with no consequences)
2	limited	Injuries/health effects resulting in temporary worker absence	Injuries/health effects resulting in temporary discomfort of a person	Simple contamination, localised effects, natural remediation			0,5 - 1 Million US$	Disturbance in affected area of company, without significant press coverage in the media)
3	serious	Injuries/health effects resulting in temporary disablement	Injuries/health effects resulting in temporary disablement of a person	Simple contamination, widespread effects with need for simple remediation			1 - 5 Million US$	Partial evacuation of company and/or negative press coverage in local media)
4	very serious	Death or serious injuries/health effects resulting in permanent disablement of a worker	Death or serious injuries/health effects resulting in permanent disablement of a person	Heavy contamination, localised effects with need for remediation			5 - 20 Million US$	Evacuation of company and/or negative press coverage in national media
5	catastrophic	Death or serious injuries/health effects resulting in permanent disablement of several workers	Death or serious injuries/health effects resulting in permanent disablement of several persons, community evacuation	Very heavy contamination, widespread effects with need for remediation)			> 20 Million US$	Evacuation of community, negative press coverage in international media

Remember:

You will need to define your own servity ratings as part of your risk assessment procedure.

4.1. ASSESS AND MAP CHEMICAL RISKS

ASSESS THE RISKS - COMMON APPROACHES

Example for probability ratings (Source: UNEP Responsible Production)

Probability/ Frequency		Example 1	Example 2
1	Practically impossible	Not expected to happen during the lifespan of the operation	Infrequent; known to have happened somewhere else
2	Unlikely	Never happened, but could occur, perhaps during the lifespan of the operation	At least once in a year;
3	Rarely	Expected to occur at least once every 10 years	At least once to five times a month
4	Regularly	Expected to occur at least once per year	At least once to five times a week
5	Frequently	Occurring more than once per year	At least once a day

Remember:

You will need to define your own probability ratings as part of your risk assessment procedure.

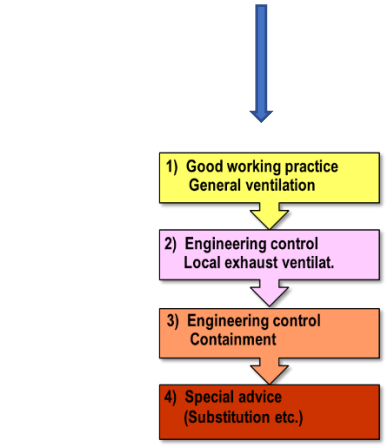
4.1. ASSESS AND MAP CHEMICAL RISKS

ASSESS THE RISKS – USING CONTROL BANDING

An alternative risk assessment approach is **"Control Banding"**. This is qualitative or semi-quantitative risk assessment and management approach which emphasises on identifiying the controls needed to prevent hazardous substances from causing harm to people at work.

It is based on the principle that the greater the potential for harm, the greater the degree of control needed to manage the situation and make the risk "acceptable." The result of this risk assessment approach is a risk band or control approach indicator, which is linked to a specific control technology or strategy (= control approach). Each control approach refers to a standardized control guidance sheet which provide specific recommendations on how to control the task or situation specific risks. As a next step, you can assess the situation by comparing the recommendations with the situation or conditions at hand. Control banding approaches are presently available for exposure by inhalation and skin contact as well as assessment of fire risks.

Amount used	Low dustiness or low volatility	Medium volatility	Medium dustiness	High dustiness or high volatility
Hazard Group A				
grams or millilitres	1	1	1	1
kilograms or litres	1	1	1	2
tonnes or cubic metres	1	1	2	2
Hazard Group B				
grams or millilitres	1	1	1	1
kilograms or litres	1	2	2	2
tonnes or cubic metres	1	2	3	3
Hazard Group C				
grams or millilitres	1	2	1	2
kilograms or litres	2	3	3	3
tonnes or cubic metres	2	4	4	4
Hazard Group D				
grams or millilitres	2	3	2	3
kilograms or litres	3	4	4	4
tonnes or cubic metres	3	4	4	4
Hazard Group E				
	For all substances in hazard group E control approach 4 is required			



4.1. ASSESS AND MAP CHEMICAL RISKS

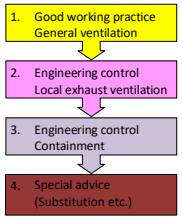
ASSESS THE RISKS – USING CONTROL BANDING

Example: Control banding for inhalation

Amount used	Low dustiness or low volatility	Medium volatility	Medium dustiness	High dustiness or high volatility
		Hazard Group A		
grams or millilitres	1	1	1	1
kilograms or litres	1	1	1	2
tonnes or cubic metres	1	1	2	2
		Hazard Group B		
grams or millilitres	1	1	1	1
kilograms or litres	1	2	2	2
tonnes or cubic metres	1	2	3	3
		Hazard Group C		
grams or millilitres	1	2	1	2
kilograms or litres	2	3	3	3
tonnes or cubic metres	2	4	4	4
		Hazard Group D		
grams or millilitres	2	3	2	3
kilograms or litres	3	4	4	4
tonnes or cubic metres	3	4	4	4
		Hazard Group E		
	For all substance in hazard group E control approach 4 is required			

Basic approach

1. Identify the hazard group and hazard band of the chemical substance (see section 3.2)
2. Determine the amount used in the specific task/situation
3. Assess the dustiness/volatility
4. Identify the control approach/risk band



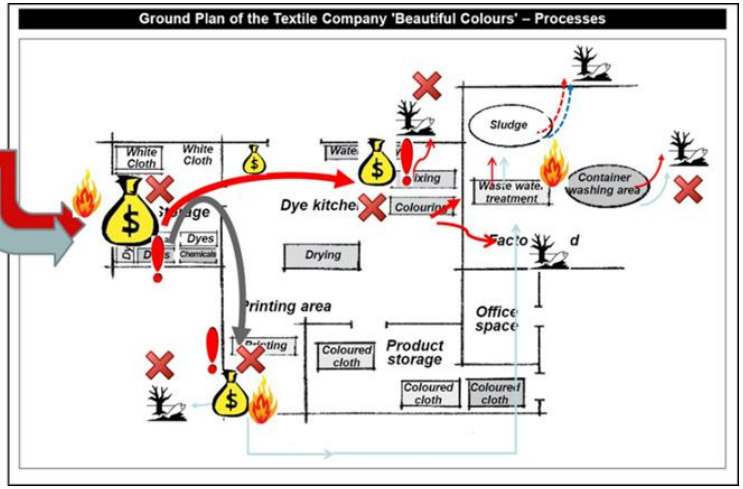
5. Consult respective control guidance sheet to assess situation at hand

4.1. ASSESS AND MAP CHEMICAL RISKS

DOCUMENT THE RISK ASSESSMENT RESULTS

In order to identify gaps between existing and recommend controls, you can use the standardized control guidance sheet of the control banding tool and refer to the safety data sheets as well as your chemical suppliers` technical data sheets control guidance sheets. To simplify the planning of control interventions as well as the monitoring progress, consider including the findings into your eco-maps and cross-referencing to these in a risk inventory table.

Updated eco-maps



Risk inventory table

Company Name/Department		Completed by	EHS Officer		Date	dd.mm.yyyy				
"Beautiful Colours"		Worksheet for Identification and Recording of Impacts								
		Cost, environmental, health & safety, productivity, legal and image impacts								
Observations		Results in monetary loss to company	Causes air pollution	Results in water/groundwater contamination	Results in soil contamination	Adds to waste disposal and environmental costs	Adds to consumption of natural resources	Contributes to global warming, ozone depletion	Affects health of staff/worker/society	Contributes to emergencies (fire/explosion, accident)	Effects relationship with customers	Leads to legal consequences or public reactions
0023	Manual mixing of dyes in dye kitchen	High	n.a.	Medium	Medium	Medium	n.a.	n.a.	High	Low	Low	Low
0024	xxxx	...	...	...	...	...	...	...	...	...	...	...

4.1. ASSESS AND MAP CHEMICAL RISKS

DOCUMENT THE RISK ASSESSMENT RESULTS - EXAMPLE

Systematically record and prioritize the findings from risk assessment for further reference in plan corrective action.

Company Name/Department		Completed by	EHS Officer	Date	dd.mm.yyyy
"Beautiful Colours"		Worksheet for Identification and Recording of Impacts			

Observations		Cost, environmental, health & safety, productivity, legal and image impacts										
		Results in monetary loss to company	Causes air pollution	Results in water/groundwater contamination	Results in soil contamination	Adds to waste disposal and environmental costs	Adds to consumption of natural resources	Contributes to global warming, ozone depletion	Affects health of staff/worker/society	Contributes to emergencies (fire/explosion, accident)	Effects relationship with customers	Leads to legal consequences or public reactions
0023	Manual mixing of dyes in dye kitchen	High	n.a.	Medium	Medium	Medium	n.a.	n.a.	High	Low	Low	Low
0024	xxxx	…	…	…	…	…	…	…	…	…	…	…

Source: Adapted from PRE-SME, UNIDO/UNEP

4.1. ASSESS AND MAP CHEMICAL RISKS

VERIFY COMPLIANCE WITH EXPOSURE LIMITS

To verify the compliance with specific existing exposure or environmental limits, further monitoring and other means of verification (e.g. indoor or outdoor ambient air and/or personal exposure monitoring and examinations) with the help of experts such as occupational/ industrial hygienists, environmental laboratories may be necessary, based on standardised sampling, monitoring ands analytical methods. The results will not only confirm your organization's compliance but also indicate how effective your controls are.

Example: Occupational exposure limits for inhalation of Hydrogen Peroxide (Source: GESTIS databank)

Country	Limit value for long-term exposure (usually 8-hour average)		Limit value for short-term exposure (usually 15 min)	
China	-	1.5 mg/m3	-	-
Germany	0.5 ppm	0.71 mg/m3	0.5 ppm	0,71 mg/m3
UK	1 ppm	1.4 mg/m3	2 ppm	2.8 mg/m3
USA (as per NIOSH)	1 ppm	1.4 mg/m3	-	-

Practical tip:

The safety data sheets (SDS) list the applicable occupational exposure limits (OEL). However, you need to cross-check with the respective legislation in your own country.

USEFUL LINKS FOR COMPLETING STEP 4, TASK 4.1

Click on the green document icons to get further information

For further information and use ***Some useful links***		
	Control banding	Guidance sheet for using control banding approach
	COSHH Essential	Link to web-based tool of Control of Substances Hazardous to Health (COSHH) Essential www.hse.gov.uk/coshh/essentials/coshh-tool.htm
	Risk inventory template	Download template of risk inventory table

Practical tips:

Check the safety data sheets and technical data sheets or the “Control banding guidance sheets” information on the recommended controls and identify the gaps between existing and recommended controls.

4.2. IDENTIFY CHEMICALS AND PROCESSES OF CONCERNS

With the enhanced chemical inventory in place, you can easily identify those chemicals of special concern for your customers and other stakeholders.

Your customer may refer to standardized lists such as the **ZDHC Manufacture Restricted Substances List** (ZDHC MRSL), **Bluesign System Substances List** (blue sign BSSL), the European REACH or customer specific **Restricted Substances Lists** (RSL). Gather also information about substances banned, restricted or otherwise regulated in the respective national regulatory framework. Any of these lists should have been already identified and listed in your inventory of regulatory requirements (see 2.4).

Under the **European REACH** regulation, special attention should be paid to **Chemicals/Substances of High Concern** (CoHC/SoHC) and **Chemicals/Substances of Concern** (CoC/SoC). You may have already identified these chemicals during the hazard identification in step 3.

4.2. IDENTIFY CHEMICALS AND PROCESSES OF CONCERNS

SUBSTANCES OF CONCERN

Example under European REACH

Chemicals of High Concern (CoHC)	Chemicals of Concern (CoC)
• Carcinogenic, mutagenic or toxic to reproduction (CMR 1A or 1B); • Persistent, bio-accumulative and toxic substance (PBT per criteria according to Section 1 Annex XIII, REACH) • Endocrine disruptors or neurotoxins • Chemical whose breakdown products result in a CoHC that meets any of the preceding criteria. • Found on Chemsec's SIN LIST: http://sinlist.chemsec.org/	• Of moderate concern for ecotoxicity or human toxicity, but not a Chemical of High Concern (CoHC). • with GHS signal word "DANGER" • classified as an allergenic (respiratory or skin sensitization, Category 1, 1A and 1B; containing H334 or H317) • classified as environmentally hazardous, long-term effects (Hazardous to the aquatic environment, chronic category 1 and 4: H410 or H413), • found on California's Candidate List https://calsafer.dtsc.ca.gov/chemical/search.aspx

4.2. IDENTIFY CHEMICALS AND PROCESSES OF CONCERNS

Processes of concern are those areas where gaps between recommended and existing control exists as well as for which you have assigned a high-risk rating during the risk assessment process (see 4.1).

As part of your organization's requirements under ZDHC, establish, document and implement a process for verifying compliance with any such restricted substances lists. The compliance verification can be part of the purchase and audit process in your organization.

As per these requirements, your company needs to maintain records (e.g. chemical inventory) and records indicating how you conduct the compliance verification and the results. In case such restricted substances are identified, specific action plans are to be drawn up on how to eliminate these from your production.

Check in your company

- ☐ Have you identified the applicable restricted substances list your organization subscribes to?
- ☐ Can you verify that you follow a process in which you regularly review the chemicals used in processes, and/or that can be found in your products, against published lists to identify chemicals of concern (e.g. REACH Substance of Very High concern, California Department of Toxic Substances Control)?
- ☐ Does your inventory table contain any chemical substances on the restricted substances list?

USEFUL LINKS FOR COMPLETING STEP 4, TASK 4.2

Click on the green document icons to get further information

For further guidance on substitution of chemicals and processes of concern, check with section 6.2. - Elimination of hazards through chemical and process substitution

For further information and use ***Some useful links***		
	Chemsec's SIN LIST	http://sinlist.chemsec.org/
	California's Candidate List	https://calsafer.dtsc.ca.gov/chemical/search.aspx
	CoHC Assessment tool	Online tool for verification of substances for qualifying as Substance of Very High concern http://textileguide.chemsec.org/
	ZDHC MRSL	www.roadmaptozero.com/programme/manufacturing-restricted-substances-list-mrsl-conformity-guidance/
	Bluesign System Substances List	www.bluesign.com/industry/infocenter/downloads

STEP 5

PLANNING AND PRIORITIZING

After understanding the situation at hand, it is time to develop your plans. In this step, you will

- Decide on objectives, targets and performance indicators
- Prepare action plan with specific measures, as well as
- Set up an organisational structure
- Assess training needs and develop training plans

These plans will not only address risk control measures related to your hazard and risk assessing processes, but also look into measures which help to anchor and up-scale the chemical management system element throughout your company.

Tasks/Elements

5.1. Formulate performance goals and action plans

5.2. Assign roles and responsibilities

5.3. Assess training needs

ZDHC CMS References

ZDHC 2.4.2 Environmental

ZDHC 2.4.3 Health and Safety

ZDHC 2.6 Performance Goals and Action Plans

ZDHC 2.6.1 MRSL Compliant Formulations

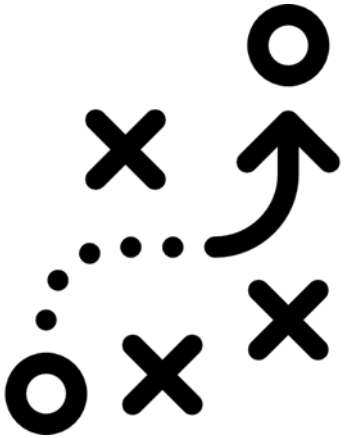
ZDHC 2.6.2 Alternatives Assessment

ZDHC 3.1.1 Roles and Responsibilities

ZDHC 4.1.1 Goal Progress

ZDHC 4.4 Change Management and Corrective Action

5.1. FORMULATE PERFORMANCE GOALS AND ACTION PLANS



Your first set of action plans will most likely focus on establishing, enhancing or fine-tuning the chemical management system elements as described during the previous steps, for example completing the chemical inventory, establishing procedures and process and/or compiling data.

Your further sets of action plans will deal with enhancing the chemical management performance of your company, for example by addressing risk control gaps and/or reducing hazards and risks.

With particular reference to the ZDHC Program, your company is expected to develop action plans for

- reducing environmental impacts (ref. CMS 2.4.2)
- reducing health and safety impacts (ref. CMS 2.4.3)
- phasing out the intentional use of priority hazardous chemicals using clear target dates to deal with chemicals and processes of concerns and achieve compliance with the ZDHC MRSL.

5.1. FORMULATE PERFORMANCE GOALS AND ACTION PLANS

DEFINE OBJECTIVES AND TARGETS

Your selection of specific objectives and targets will build on the information collected in the previous steps such as process flow diagrams, chemical inventory, map of hotspots, hazard and risk analysis records (e.g. chemicals and process of concerns).

The objectives and target and subsequent your action plan may initially also focus on the establishment or fine-tuning of your basic chemical management systems elements, addressing “hotspots” (those areas which pose an immediate impact on health and safety, environment, costs) and in due course on systematically improving the performance of your company.

Together with the key performance indicators, the objectives, targets and selected control measures recorded your action plans establish the basis for implementing measures, making improvements, monitoring progress and evaluating results.

Objectives/Goals

well-defined, targeted statements that give you clarity, direction and focus of what you want to achieve

Targets

more measure and/or activity oriented verifiable statements which serve as interim pointers towards achieving an objective/goal

(Key) performance indicator

a measurable value that demonstrates how effectively a company is moving towards (key) objectives/goals as well as describes to which extent targets are met

5.1. PREPARE ACTION AND PERFORMANCE PLANS

DEFINE OBJECTIVES AND TARGETS

Example – Relationship between objectives, targets and indicators

#	Hazardous chemical/ critical situation/ loss/ identified gap	Target	Objective/goal of proposed measure	Necessary action/ activities for achieving target	Person Responsible	Deadline	Results/ indicators to be monitored
1	Several chemicals cannot be clearly identified due to missing labels.	Reduce the number of unlabelled containers to 5%	To improve the company internal hazard communication on chemicals used				% of unlabelled containers
2	…						

The issue to be addressed

The measurable result of the interventions

The larger context or purpose of the interventions

The selected performance indicator

5.1. PREPARE ACTION AND PERFORMANCE PLANS

SELECT CHEMICAL MANAGEMENT PERFORMANCE INDICATORS

Monitoring and measuring performance will help you to:

- Compare performance over time;
- Highlight improvement and optimization potentials;
- Identify and follow up on targets;
- Discover opportunities and cost-reduction potentials;
- Communicate your results to external stakeholders;
- Involve, educate and motivate staff;
- Promote organizational learning;
- Support decision-making by providing concise information about the current status and trends with regard to resource use and performance; and
- Implement environmental management systems or generate information needed for your current environmental management system.

"You can only manage what you know and can measure!"

5.1. PREPARE ACTION AND PERFORMANCE PLANS

SELECT CHEMICAL MANAGEMENT PERFORMANCE INDICATORS

The selection (key) performance indicator will help you to mark whether or not you are making wanted progress as well as to further define/frame objectives and targets in your action plans. At the same time, these will also help you to communicate your company`s performance to relevant stakeholders.

As part of this process also decide on how and how frequently you would like to assess the performance. It is important that you tailor the selection of indicators to your type of operations.

Make sure that the selected indicators are (a) understandable, (b) relevant, (c) reliable; and (d) comparable. These should reflect the management efforts chemical management, operational performance aspects and combine leading and lagging indictors

Select **ACCURATE** Indicators:

- **A**ssessable or measurable;
- **C**ontrollable - able to be changed by what you do in chemical management;
- **C**entral and relevant to what you are trying to achieve;
- **U**nderstandable and clear;
- **R**eliable - providing the same measures when assessed by different people;
- **A**cceptable to the users as true indicators of performance;
- **T**imely; and
- **E**fficient to monitor.

5.1. FORMULATE PERFORMANCE GOALS AND ACTION PLANS

SELECT CHEMICAL MANAGEMENT PERFORMANCE INDICATORS

The right mix of indicators may reflect chemical inputs, chemical wastes, chemical management efforts and chemical management performance.

Chemical management performance indicators describe the result of the chemical management efforts such as number of incidences/accidents involving over period of time, incident/accident free days worked or non-product outputs reduced.

- ► Indicators such as number of chemical safety trainings or emergency drills conducted, percentage of safety data sheets available, number of inspections conducted will describe chemical management efforts as such.

Indicators related to chemical inputs and waste can be

(i) absolute indicators, such as total quantity of chemicals used (overall, or specific type in kg, liters per day month, year) or total amount of chemical containing waste water(hazardous/non-hazardous) generated (liters, cubic meter per day , month or year),

(ii) ratio figures such as percentage of hazardous chemicals or percentage of hazardous waste or

(iii) productivity/intensity indicators, such as chemical productivity (product output per unit of chemical used) or chemical hazardous waste intensity (hazardous waste generation per unit of product output).

5.1. PREPARE ACTION AND PERFORMANCE PLANS

SELECT CHEMICAL MANAGEMENT PERFORMANCE INDICATORS - EXAMPLES

Performance area	Possible performance indicator
Chemical inputs	• Quantity of (total/ hazardous) chemicals stored storage and/or used • Quantity of hazardous chemicals reduced
Chemical management performance	• Number of hazardous chemicals substituted by less dangerous materials • Number of chemicals on ZDHC MRSL eliminated • Number of non-compliance/non-conformances observed/reported • Number of accidents and near-misses and their severity involving chemicals • Number of injuries and fatalities from chemical accidents • Costs related to chemical accidents (loss of product, liabilities, fines, property damage) • Number of workdays without/Reduction of frequency of accidents and near-misses, and their severity; • Reduction of injuries and fatalities from chemical accidents occurring at site and along the company's chemical product value chain • Reduction of environmental impacts from chemical accidents occurring at site and along the company's chemical product value chain; • Reduction of property damage from chemical accidents occurring at site and along the company's chemical product value chain;

5.1. PREPARE ACTION AND PERFORMANCE PLANS

SELECT CHEMICAL MANAGEMENT PERFORMANCE INDICATORS - EXAMPLES

Performance area	Possible performance indicator
Chemical management performance	• Reduction of injuries and fatalities from chemical accidents occurring at site and along the company's chemical product value chain • Reduction of environmental impacts from chemical accidents occurring at site and along the company's chemical product value chain; • Reduction of property damage from chemical accidents occurring at site and along the company's chemical product value chain;
Improvement of chemical hazard communication and documentation	• Number of chemicals with/without safety data sheets (SDS) • Number of labelled/unlabeled chemical/waste containers
Chemical management efforts	• Number of internal risk awareness campaigns and training sessions conducted • Number of workers trained on chemical safety issues • Number of chemical emergency drills conducted • Changes to operating procedures/instructions for improving chemical safety • Number of non-compliance/non-conformances /addressed

5.1. FORMULATE PERFORMANCE GOALS AND ACTION PLANS

SELECT MEASURES TO ADDRESS THE ROOT CAUSE

In addition to the objectives, targets and performance indicators, you will need to decide what action to take to best address the situation. To effectively address a situation, avoid addressing the obvious symptoms only, but focus on the underlying root causes and contributing factors instead.

Often the contributing factors are not visible or immediately obvious. **Root causes** can be often related to management system issues, for example missing or inadequate procedures, no hazard or risk analysis or poor supervision.

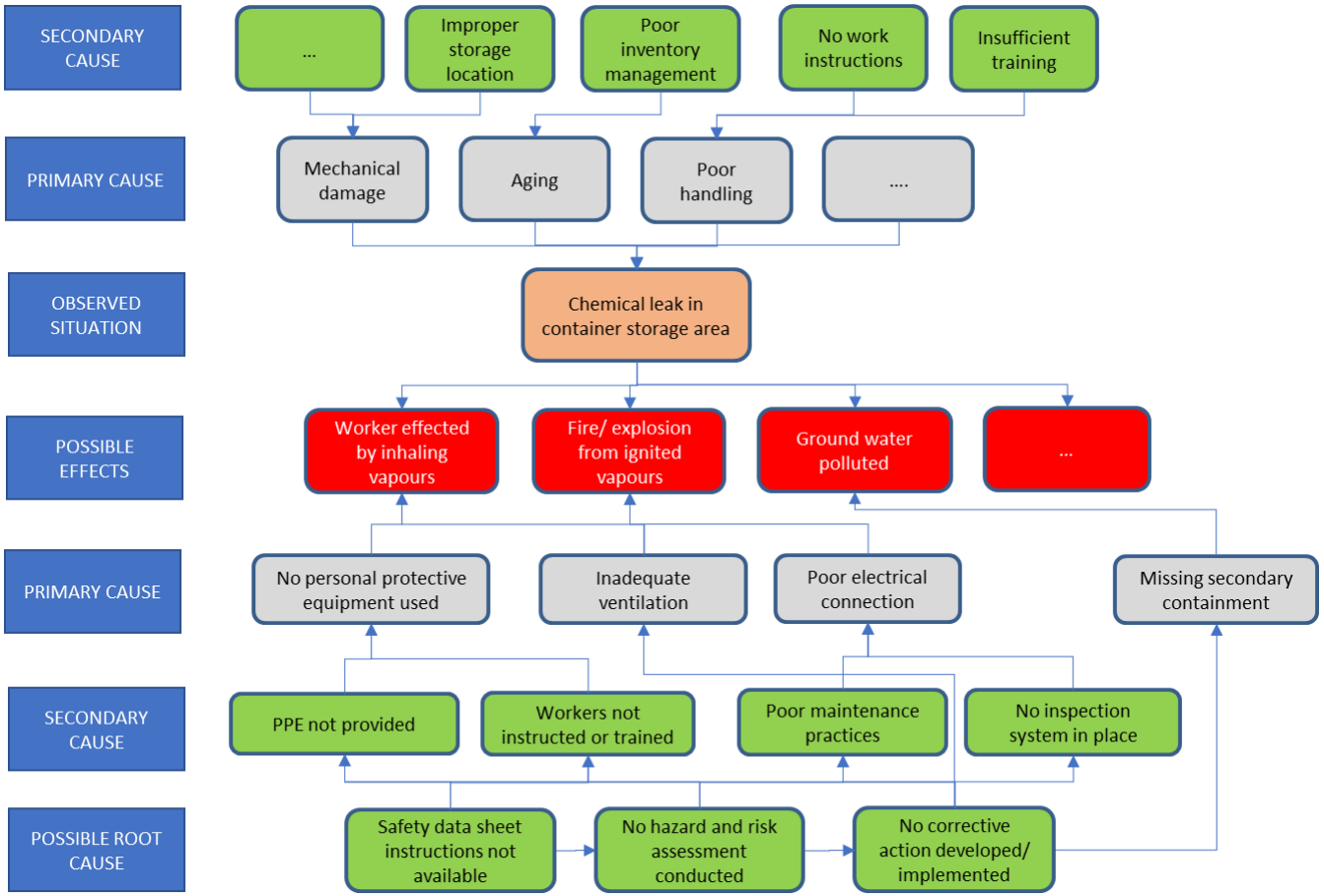
Various practical methods are available to carry out such an analysis of the situation and identify its actual causes or contributing factors.

Examples of common tools for root cause analysis

- Five Whys Analysis
- Failure Mode and Effects Analysis (FMEA)
- Fault Tree Analysis
- Fishbone or Ishikawa or Cause-and-Effect Diagrams

5.1. FORMULATE PERFORMANCE GOALS AND ACTION PLANS

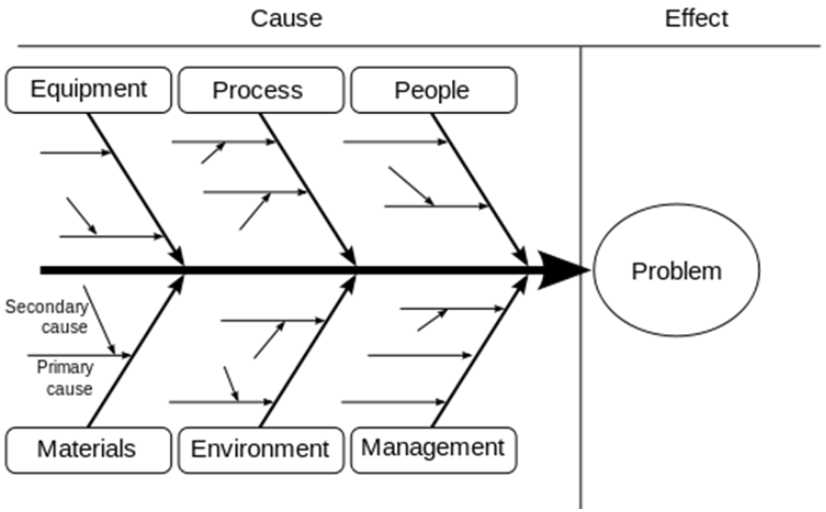
SELECT MEASURES TO ADDRESS THE ROOT CAUSE - EXAMPLE



Can you spot the root causes to adress?

5.1. FORMULATE PERFORMANCE GOALS AND ACTION PLANS

SELECT MEASURES TO ADDRESS THE ROOT CAUSE



Fishbone or Ishikawa diagram

Example 2:

You see a worker handling a certain hazardous chemical without using personal protective equipment PPE). There is a high chance that the worker may suffer from immediate health problems.

The immediate solution may be to provide PPE. But ask yourself: Why did the worker not use any PPE?

You may for example discover (1) the worn out PPE was not replaced, or (2) the PPE is there, but the worker does not want to use it, or (3) the PPE is there, but the worker does not know how to use it: or (4) …..

You ask yourself again why….,; you may discover (1) there is not procedure for PPE maintenance and replacement, or (2) no work instruction, or (3) not enforcement of an existing work instruction, or (5) no training on proper use of PPE has been planned or implemented.

Properly analysing the situation will allow you to address the real causes in an effective and sustainable way.

5.1. FORMULATE PERFORMANCE GOALS AND ACTION PLANS

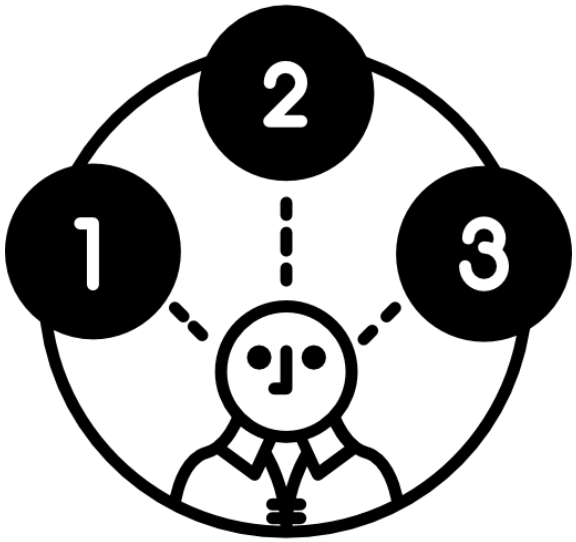
SELECT MEASURES TO ADDRESS THE ROOT CAUSE

There may be several options available to address the same issue. In order to decide the most suitable measures, the various option can be compared with each other.

(1) **Technical feasibility** (technical capabilities, training required, process adaptations required, product quality assurance,….)

(2) Extent of **positive/negative** environmental/ ecological as well as health & safety **effects**

(3) **Economic/financial implications** (capital investments required, increase/decrease of operating costs, savings,…)



5.1. FORMULATE PERFORMANCE GOALS AND ACTION PLANS

COMPILE YOUR ACTION PLANS

To round off your action plans and to make sure that the actions gets done, it needs to be clear

- ☐ who shall do
- ☐ what
- ☐ how and
- ☐ by when.

Ref.	Hazardous chemical/ critical situation/loss/ identified gap	Proposed measure	Objective of proposed measure	Necessary action/ activities for implementing measure	By whom	By when	Results/ indicators to be monitored	Monitoring
3	3.1 Existing exhaust ventilation dispersing exhaust air into breathing zone outside the screen stripping room.	3.1 Arrange for exhaustion of contaminate air away from stripping area	To reduce of adverse health effects of workers in and around stripping area during regular work and emergency situations	3.1.1 Install exhaust duct to roof top level for better removal of exhaust air from the work area	Mechanical department	15th Dec 20xx	Reduced presence of phenol bath vapours behind stripping room	
				3.1.2 Design and install possible local exhaust from roller bath	Mechanical department	31st Dec 20xx	Reduce concentration of phenol vapours inside the stripping room	

Remember

When assigning responsibilities to implement the action plans or assigned tasks, you need to make sure that these persons

1. have the necessary expertise or have the opportunity obtain such expertise
2. have or are provided with the necessary authority; and
3. are allocated with the required resources

Getting your top management endorsement is the final stage to go through.

Develop and sell your business cases!

5.1. FORMULATE PERFORMANCE GOALS AND ACTION PLANS

COMPILE YOUR ACTION PLANS - EXAMPLE

Ref.	Hazardous chemical/ critical situation/loss/ identified gap	Proposed measure	Objective of proposed measure	Necessary action/ activities for implementing measure	By whom	By when	Results/ indicators to be monitored	Monitoring
…	….	…	…	…	…	…	….	….
3	3.1 Existing exhaust ventilation dispersing exhaust air into breathing zone outside the screen stripping room.	3.1. Arrange for exhaustion of contaminate air away from stripping area	To reduce of adverse health effects of workers in and around stripping area during regular work and emergency situations	3.1.1 Install exhaust duct to roof top level for better removal of exhaust air from the work area	Mechanical department	15th Dec 20xx	Reduced presence of phenol bath vapours behind stripping room	
				3.1.2 Design and install possible local exhaust from roller bath	Mechanical department	31st Dec 20xx	Reduce concentration of phenol vapours inside the stripping room	
….	…	…	…	…	…	…	…	…

5.2. ASSIGNING ROLES AND RESPONSIBILITIES

In order to make the CMS operational, the company needs to establish an organisational structure clearly assigning the roles and responsibilities under the CMS. At the same the company's management will have to make the essential human resources, specialised skills, organisational infrastructure, technology and financial resources available.

For assigning the roles and responsibilities ask yourself following questions:

- ❑ Which roles are there in the CMS?
- ❑ What are the respective responsibilities?
- ❑ Which sections/department/organisation units would be responsible for what role?
- ❑ What are the specific related tasks?
- ❑ What roles and responsibilities already exist in your company's management system? Where are the opportunities for integration and linking the CMS?

5.2. ASSIGNING ROLES AND RESPONSIBILITIES

Roles assigned for	Specific responsibilities
CMS oversight	• Reports to senior leadership • Responsible for day-to-day management of CMS • Responsible for tracking progress on key performance indicators (KPIs) and goals
Regulatory compliance	• Systematically monitors applicable regulations on a regular schedule for each applicable legal jurisdiction • Identifies new or changing compliance requirements
RSL and MRSL oversight	• Responsible for RSL and MRSL compliance and communication with supply chain partners
Chemical application and management	• Responsible for process and product chemical knowledge • Responsible for knowing the contact names of individuals at supply chain partner organisations with the same duties
Hazard assessment and risk management	• Responsible for activities related to chemical hazard assessment • Responsible for knowing the contact names of individuals at supply chain partner organisations with the same duties
Alternatives assessment	• Responsible for activities related to safer alternative assessment and communicating information to supply chain partners
Community of practice and sustainable chemistry	• Acts as organisation's representative for Chemical Management Community of Practice • Responsible for chemicals management and sustainable chemistry metrics

Ref. ZDHC CMS - 3.1.1 Roles and Responsibilities

5.2. ASSIGNING ROLES AND RESPONSIBILITIES

Once you have identified the different roles and responsibilities for running and maintaining the chemical management system as well as achieving the company's goals, assign the responsibilities to the appropriate sections and/or positions.

Various sections or persons in your company may have to take care of multiple roles, such as taking the lead or directly/ indirectly supporting the implementation of tasks.

Section	Responsibility
Purchase	• Develop and implement controls for chemical purchases
Human resources	• Define competency requirements and job descriptions for various CMS roles • Integrate chemical management into reward, discipline and appraisal systems
Maintenance	• Implement preventive maintenance program for key equipment (e.g. dosing pumps, secondary containment, storage arrangements,…)
Engineering	• Consider EHS impacts of new or modified products and processes • Identify chemical pollution/hazard prevention opportunities
Top management	• Communicate importance of CMS throughout organization • Provide necessary resources • Track and review CMS performance
Production	• Provide first-hand knowledge of chemicals' EHS aspects of their operations • Implement good practices for resource efficient management of chemicals • Support training for new employees
…	…

5.2. ASSIGNING ROLES AND RESPONSIBILITIES
Develop a responsibility matrix

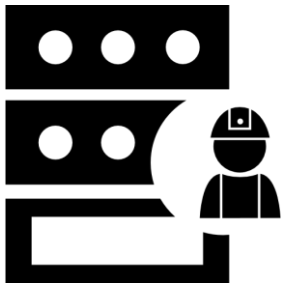
Example	Plant Mgr	EHS Mgr	HR Mgr.	Purchase officer	Maintenance in-charge	ProductioMgr.	Super-visor	Worker	ETP in-charge	…
Communicate importance of CMS	L	S	S			S	S			
Coordinate audit efforts		L			S	S				
Obtain permits and compliance plan		L			S	S			S	
Train staff on CMS and good practices		S	L			S	S			
Identify, assess and document chemical hazards and risk	S	L	S	S	S	S	S	S	S	
Establish objectives and targets, action plans	L	S	S	S		S			S	
Maintain CMS records		L								
…..										

L…Lead role, S…Supporting role

5.2. ASSIGNING ROLES AND RESPONSIBILITIES

How to proceed

- Review the existing job description and verify existing references to chemical management related roles, responsibilities and tasks
- Include the corresponding tasks related to chemical management at the different levels in your company.



The next pages outlines the roles and responsibilities of employers and employees as per the ILO Code of Practice, R177 Safety in use of chemicals at work.

- As per ZDHC CMS, you company is expected to develop a Chemical Management System (CMS) organizational chart.

5.2. ASSIGNING ROLES AND RESPONSIBILITIES

Management/Employers

ensure that chemicals are stored safely, and that unauthorized access is prevented

ensure that workers are protected against accidents, injury and poisoning at work by

(a) as far as possible, choosing chemicals that eliminate or minimize the risk

(b) choosing the appropriate equipment and machinery for work with chemicals

(c) making sure that all chemicals are correctly labeled, and that safety data sheets are provided and made available to workers and their representatives

(d) know the risks inherent to each chemical and minimize these risks through appropriate control methods

(e) instructing all workers, particularly those who are new or functionally illiterate, about the hazards and the safety precautions

(f) undertaking effective supervision of all tasks involving chemicals to ensure correct operation and prevent any hazards that may result from lack of knowledge or experience of workers

(g) carrying out maintenance, repair and periodic inspection of equipment and machinery, and workplaces

(h) complying with safety and health regulations and safe working, practices

(i) making arrangements to deal with emergencies

Workers

should cooperate with employers in carrying out their duties and should comply with all procedures and practices relating to safety and health in the use of chemicals at work.

should note and follow the instructions given by the manufacturer, supplier, employer or supervisor. Workers should take all reasonable steps to minimize risk to themselves or others, property or the environment

In addition, they should:

- use properly all devices provided for their protection or the protection of others
- examine the equipment before beginning work and report forthwith to their immediate supervisor any situation which they believe could present a risk, and which they cannot properly deal with themselves

Workers should also have the right to:

- draw the attention of their representatives or the employer to potential hazards arising from the use of chemicals at work
- remove themselves from danger resulting from the use of chemicals when they have reasonable justification to believe that there is an imminent and serious risk to their safe-ty and health
- request alternative work, in the case of a health condition placing them at increased risk of harm from a hazardous chemical,- in particular, women workers who are pregnant or breastfeeding should be able to request transfer to work that is not harmful to the unborn or nursing child
- require adequate medical treatment and compensation for injuries and diseases.

Source: ILO Code of Practice, R177

5.2. ASSIGNING ROLES AND RESPONSIBILITIES

Prepare a CMS manual

To ensure that your CMS is well understood and operating as designed, you must provide adequate information to the people doing the work. There also may be external stakeholders that want to understand how your CMS is designed and implemented, such as customers, regulatory agencies, and the public. For these reasons, the various processes that make up your CMS should be documented.

As per ZDHC the company is expected to create a CMS Manual that describes the main elements of the CMS provides direction to related documentation. The CMS manual serves as a “road map” or description that summarizes how the pieces of the CMS fit together, containing a series of explanations of the processes your company implements to conform to the CMS criteria.

If you have already similar manuals such as for your environmental or occupational safety &health management system(s), explore the scope of complementing these.

5.2. ASSIGNING ROLES AND RESPONSIBILITIES

Prepare a CMS manual

As per ZDHC, the CMS manual should include:

- Documented statements of a chemical policy and chemical objectives
- Documented procedures and records required by this manual
- Documents, including records, determined by the organisation to be necessary to ensure the effective planning, operation and control of its processes

The CMS manual describes the system's **core elements** (and how the elements relate to each other), and provides **direction** to related documentation.

This CMS manual is to be reviewed annually and update as needed.

CMS manual content

- ❑ Company policy
- ❑ Organisation chart with responsibilities (e.g. matrix)
- ❑ Company chemical policy
- ❑ Legal and Other Requirements with reference to relevant procedure (e.g. for identification of legal requirements, maintaining legal inventory,…)
- ❑ Objectives, targets and programme(s)
- ❑ Resources, roles, responsibility and authority
- ❑ Competences, training and awareness
- ❑ Documentation
- ❑ ....

Refer to the relevant standard such as ZHDC, describing your companies commitment

5.2. ASSIGNING ROLES AND RESPONSIBILITIES

Prepare a CMS manual

Example – Link between CMS manual and supporting documents

Legal and Other Requirements

Ref. ZDHC 2.2 Regulatory Assessment

COMPANY NAME chemical management permits as well as other requirements that the company subscribes to which relates to the company's chemical aspects…..

COMPANY NAME shall identify all relevant regulations, codes of practice and guidelines that are applicable to the chemical aspects of its activities, products and services, and record this information in the inventory of legal and other requirements.

COMPANY NAME shall keep this information up-to-date.

Relevant procedure : CMS-P 201 Procedure for review of legal and other requirements

….

In appendix A – Overview of cross references of standards requirements (e.g. ZDHC) and sections in the CMS manual and CMS procedures.

ZDHC Section	ZHDC CMS Ref.	CMS Procedure Ref. No.
…	…	…
Legal and other requirements	2.2.1 Monitoring Regulations and permits	CMS-P 201
…	…	…

Appendix B - Controlled Document List

Document No.	
…	…
CMS-P 201	Procedure for review of legal and other requirements
…	…

5.2. ASSIGNING ROLES AND RESPONSIBILITIES
Document and record controls

According to the ZDHC the company is also expected to establish, document and implement a process for controlling documents and records associated with the CMS.

1. Approve documents for adequacy prior to issue
2. Review, update and re-approve documents
3. Ensure that changes and the current revision status of documents are identified
4. Ensure that the most up to date versions of documents are available at the appropriate points of use
5. Ensure that documents are legible and readily identifiable
6. Ensure that documents of external origin, determined by the organisation to be necessary for the planning and operation of the CMS, are identified and their distribution controlled
7. Prevent the unintended use of obsolete documents and apply suitable identification to the files

Key questions for record control

- ❑ What records are kept?
- ❑ Who keeps them?
- ❑ Where are they kept?
- ❑ How are they kept?
- ❑ How long are they kept?
- ❑ How are they accessed?
- ❑ How are they disposed?

5.3. ASSESS THE TRAINING NEEDS

The successful adoption of the new concepts and practices will largely depend on the **knowledge**, **skills** and **attitude** of the workforce in your company. Consider the following questions to determine what training your staff/workers require:

- ☐ What are the competences the staff/workers need (competence profile) in implementing chemical management in your company?
- ☐ What is the current education, training and/or experience of staff/workers?
- ☐ Are there gaps between the competence profile and staff/workers' competences at the different levels?
- ☐ Have you introduced new or changed procedures or work instructions?

According to the ZDHC CMS Guideline, you are to ensure that your personnel is competent through appropriate education, training or experience on

- ► Preventive environmental and work safety practices
- ► Saving resources
- ► Use of personal protective equipment
- ► Personal hygiene measures

5.3. ASSESS THE TRAINING NEEDS

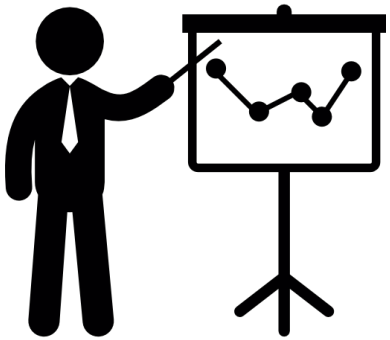
FROM TRAINING NEEDS TO LEARNING OBJECTIVES

Training involves a combination of skills development, knowledge transfer, development and support of understanding and sustained attitude change. Once you have identified the raining needs, you can translate these into training or learning objectives.

Be sure about which issue do you want to address. For example, do you want…

- ☐ to bridge identified skills gaps
- ☐ to ensure knowledge required for effective implementation of the CM elements and practices
- ☐ to challenge existing perceptions about CM
- ☐ to help staff understand and deal with change represented by the CM

The better you define your learning objectives at this stage, the easier it will become to develop and effectively implement as well as monitor your training programs.



Practical tip:

An easy way to define the learning objectives/ outcomes of the training interventions is to put yourself into place of the training recipient and ask yourself the following question:

At the end of this training, I (or the participants) will be able to….

See next page for some examples

5.3. ASSESS THE TRAINING NEEDS

FROM TRAINING NEEDS TO LEARNING OBJECTIVES - EXAMPLES

At the end of this training, I (or the participants) will be able to….

…distinguish between the different hazard pictograms on a chemical container	…select the correct personal protective equipment.	…identify and report an unsafe condition to their supervisor.	… select the suitable firefighting equipment.	… take remedial action in case of a chemical splash on the eyes.
… explain how he/she can be exposed to chemical hazards.	…use the protective mask in the prescribed way.	…prepare a work instruction based on content safety data sheet.	…review and update the emergency plan of the company.	…assess the company`s performance using key performance indicators.

Click on the icon or refer to 'Learning objectives' to get a list of action words for different types learning needs.

5.3. ASSESS THE TRAINING NEEDS

DECIDE HOW TO IMPLEMENT YOUR TRAINING PROGRAMME

Your training will only be effective, if suitable training methods are used. Your selection of training methods, contents, duration and delivery depends on the desired training outcome and the level of education of your trainees. For example, you will probably differentiate your approach whether you are going to train your top management, middle management and supervisors or workers. Above all, everyone will have his/her own preferred learning style.

Ask yourself:

- What is the comprehension level of the training target group?
- What is their background experience?
- What is their familiarity with subject matter?

If you are not sure, contact a professional training provider to help with this task.

Example of different types of training

Lectures are suited to general overview and introduction of new ideas. With a retention of 20% one of the least effective training methods.

Group discussion: Participants are much more involved than in lectures.

Videos: A well-produced video can be an eye-catcher. But too often video is used as a light break in a training session rather than as an integral part.

Case study/role play: Excellent technique to engage trainees in activities which specifically address organizational needs and to develop interpersonal skills.

On the job training and instructions can be effective for activities combining knowledge, skills and techniques. Very dependent on the abilities of the instructor.

5.3. ASSESS THE TRAINING NEEDS

THINK HOW YOU WILL VERIFY THE TRAINING IMPACT

To round off the your planning process on how you can address the training needs in your company, develop performance indicators for the training as well as ways decide how you can assess whether training has achieved its objectives.

For example: If you train your shop floor staff on new waste separation procedures, reduced waste to landfill may be a suitable objective.

Do not look only at short-term effectiveness: New skills and behaviors may be abandoned if not practiced and supported old habits may become the norm again. Re-evaluate any training to assess its long-term effectiveness.

For further references on training and instructions, see also section 6.4.

As per the ZDHC CMS Guidelines, you are expected to prepare

- a training matrix outlining training needs and training content (see example next page)
- a roster of training attendees

5.3. ASSESS THE TRAINING NEEDS

DEVELOPING A TRAINING MATRIX - EXAMPLE

Learning objective or subjects / Job title	Chemical hazard and exposure awareness	Recognise chemical labels and safety signs	Follow safe work practices as per work instructions	Use of personal protective equipment	Use safety data sheets	…
Production manager		●			●	
Production supervisor	●	●	●	●	●	
Store personnel	●	●	●	●	●	
ETP staff	●	●	●	●		
Worker area 1	●	●	●	●		
Worker area 2	●	●	●	●		
EHS Officers	●	●	●	●	●	
Admin.		●			●	
…..						

PLANNING AND PRIORITIZING

Consider integrating CMS with your existing:

- information systems
- purchasing controls
- quality procedures
- work instructions
- training programs
- communication efforts
- reporting systems
- recruitment, appraisal and disciplinary processes

Action points

- ✓ Prepare the responsibility matrix or similar document do document the roles and responsibilities within the CMS
- ✓ Incorporate CMS related roles, responsibilities and tasks into the respective job descriptions
- ✓ Define what competencies the involved persons (CMS knowledge, skills,..) will need to perform the assigned tasks
- ✓ Assess the competencies gaps (see section 5.3) and prepare a training plan
- ✓ Make the necessary competencies available by implementing or sending your staff to competence development programmes (training) and/or by hiring qualified persons
- ✓ Prepare a CMS manual for your chemical management system

STEP 6

IMPLEMENTING GOOD CHEMICAL MANAGEMENT PRACTICES

This part of the tookit deals with different good chemical management practices.

Tasks/Elements

6.1. Establish purchase policy and practices

6.2. Control exposure and releases

6.3. Select and use personal protective equipment

6.4. Provide training, procedures and instructions

6.5 Improve chemical handling

6.6 Safe chemical storage

6.7 Safe chemical transport

6.8 Plan and prepare for chemical emergencies

6.9 Manage and dispose chemical waste

ZDHC CMS References

- ZDHC 2.3 Procurement/Supplier Practices
- ZDHC 3.5 Chemical Management Work Practices
- ZDHC 3.6 Emergency Procedures

6.1. ESTABLISH PURCHASE POLICY AND PRACTICES

The ZDHC Chemical Management System Guideline (ref. ZDHC CMS 2.3 Procurement) outlines what how your company from your company on how to handle purchases of chemicals.

For example:

- Formulate a purchasing and disposal policy for chemicals
- List all your chemical suppliers as part of chemical inventory and
- Establish and maintain a standard operating procedure for approval and removal of supplier.

In this section you will find further guidance on how to formulate/review you purchase policy and procedure for selecting your chemical suppliers.

Take a closer look at the chemical purchase procedure and practices in your company, particularly focusing on following aspects:

- ☐ Do you procure your chemicals from a recognized manufacturer/supplier?
- ☐ Do you communicate to your chemical supplier(s) any requirements with regard to banned and restricted chemicals?
- ☐ Do you ask your supplier to provide you with supporting documents such as up-to-date Safety Data Sheet (SDS) and Technical Data Sheet (TDS)?
- ☐ Do you specify as part of your purchase orders the labelling requirements of the chemical containers?
- ☐ Do you verify container labelling and condition of chemical containers when taking delivery at your company?
- ☐ Do you sample and test chemicals when received for approval against specifications (e.g. MRSL, REACH)?

6.1. ESTABLISH PURCHASE POLICY AND PRACTICES

ESTABLISH A PURCHASING POLICY FOR CHEMICALS

Your company`s purchasing and disposal policy is meant to guide you on what you can and cannot order to reduce the risk, liability and cost to workers and staff by eliminating the purchase of unnecessary hazardous products, considering legal, safety, ZDHC MRSL and brand MRSL and RSL requirements prior to the purchase of the substances. For further details, take a look at ZDHC CMS 2.3.1 Chemical Purchasing Policy Considerations.

Example of a purchase policy:

Company XYZ procures textile dyes & chemicals with particular consideration of their environmental, health and safety and global ecological impacts to ensure doing business in environmentally sustainable manner. The concerned team of company XYZ will look out for innovations in chemical applications and continuously search for and assess safer chemicals. For the implementation of this policy, company XYZ will adhere to the relevant national rules and regulations. Furthermore, the company will comply with xxx (e.g. REACH, EPA,…) standards as well as conform to requirements of ZDHC MRSL and its buyers` restricted substances lists in the selection of chemicals.

6.1. ESTABLISH PURCHASE POLICY AND PRACTICES

SELECT AND DOCUMENT YOUR CHEMICAL SUPPLIERS

According to the ZDHC program requirements, your company is expected prove that you have established and implement a clearly defined process for identifying and using preferred suppliers and removing suppliers from the preferred list when appropriate. Such list chemical manufacturer and/or supplier should be easily retrievable from your chemical inventory (see section 2.2), in which you are expected to document the name and relevant contact details for each chemical supplier for urgent technical support or in case of emergencies (e.g. point-of-contact name, phone number and address).

You can use a checklist (see example below) for short-listing of chemical suppliers.

Does your chemical supplier…		Yes	No
☐	provide you with up-to-date safety data sheets (e.g. as per GHS) and technical data sheets?		
☐	provide you with signed and dated declarations confirming that the formulations supplied to your company are compliant with your buyers' or your own Restricted Substances Lists and/or Manufacture Restricted Substances List(s)?		
☐	have the capacity of providing you with chemicals from the „positive list“ (= MRSL approved chemicals)?		
☐	provide with chemical containers which are labelled, preferably in line with GHS established recommendations?		
☐	commit to „Responsible Care“ programme or principles?		
☐	have a “hot desk” for support in case of emergencies?		

6.1. ESTABLISH PURCHASE POLICY AND PRACTICES

TAKE CARE OF DOCUMENTATION REQUIREMENTS FOR CHEMICALS OF CONCERN

With particular reference to the substances listed in the ZDHC Manufacture Restricted Substances List (ZDHC MRSL) and buyer`s own restricted substances lists (RSL), your company is expected to obtain and keep on record signed and dated declarations from their dye and chemical suppliers confirming that the formulations supplied to the facility are compliant with the relevant retailers' or the facility's own RSL and/or MRSL.

Practical tips

Make sure that…

- Your chemical suppliers **ALWAYS** provides a current Safety Data Sheet for each chemical formulation, so can review the SDS for chemicals listed in the MRSL.
- If the formulation has not already been assessed, verify whether you can obtain a third-party testing or certification from third party certification body or recognized laboratory (as per ISO 17025) to assure MRSL or RSL compliance of the formulation.
- First party conformance declarations includes the supplier contact information, a unique formulation/ batch identification, a statement of what the formulation conforms to, and clear indications of the limitations of this conformance declaration.

USEFUL LINKS FOR COMPLETING STEP 6, TASK 6.1

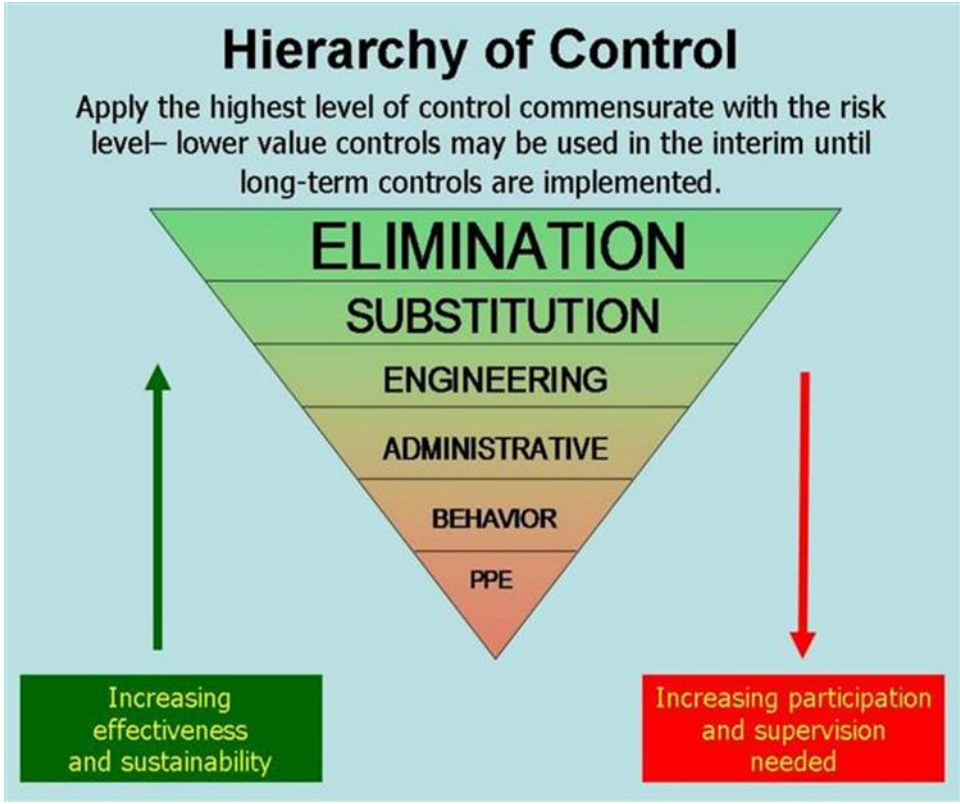
For further information and use ***Some useful links***		
	Purchase checklist	Use this sample checklist for purchasing chemicals
	Haz Chem request form	Request to Procure and Use a High Hazard Chemical form
	Supplier declaration	Example of chemical supplier`s compliance declaration

Click on the green document icons to get further information

6.2. CONTROL EXPOSURE AND RELEASES

The general objective in the control of chemical hazards is to reduce to the lowest possible level the risk that a hazardous chemical can come in contact with the worker or the environment, or that it can produce fire or an explosion. Better than reducing the risk would be eliminating the risk altogether by avoiding or substituting the hazardous chemical or, as an alternative, to improve the operation process.

To minimize risks, usually a multi-point strategy of controls can be used to prevent and reduce the possibility and thus the risk of accidents, health impacts, fire or explosion and adverse effects on the environment.



6.2. CONTROL EXPOSURE AND RELEASES

I	II	III	IV
Elimination of hazard or substitution or improved operation	**Engineering controls**	**Administrative controls**	**Protection of the worker**
Eliminate the hazardous substance or process or replace it by a less hazardous one or improve operational process	Prevent the hazard associated with the chemical from reaching the worker or environment, for example by putting distance or shielding between the substance and the worker or using general and local ventilation with filter devises to remove or reduce the concentration of airborne chemicals	Use organizational measures to reduce the duration of exposure or number of people who may get exposed, for example restricting access to storage areas, warnings, training and description of procedures indicating the restrictions	Provide personal protection to the worker to prevent physical contact with the chemical or waste

A combined approach has often proven to be more effective, for example installing engineering controls now and using personal protective equipment (PPE) until new or modified equipment is bought or an enclosure or ventilation device has been installed. These principles and control hierarchy are applied in the methods developed by ILO, HSE and BAuA based in control banding. By implementing the control banding methodology, you will be allowed to find an easy way for identifying the control methods for each chemical and situation present in your company you can also refer to guidance sheets for different processes such as filling and storage for the different levels of control needed.

For further guidance on personal protective measures, refer to section 6.3

6.2. CONTROL EXPOSURE AND RELEASES

FIND INFORMATION ON RECOMMENDED CONTROLS

- Safety data sheets
- Technical data sheets
- Control guidance sheets
- Checklists, code of conducts
- Expert advise
- Publications on common good practices (e.g. European BREF/BAT documents)

6.2. CONTROL EXPOSURE AND RELEASES

FIND INFORMATION ON RECOMMENDED CONTROLS

Check your **safety data sheets** and **technical data sheets** which contain specific information on recommended controls. Also the chemical container labels will provide you with guidance towards suggested controls. These are usually formulated in form of standardized precautionary or P-statements in line with the Globally Harmonized System of Classification and Labelling of Chemicals (GHS).

Similar to the hazard (H) statements (see section 3.2), these are abbreviated as three-digit codes preceded by the letter “P”.

P-statement	Category of precautionary measures
P1xx	General measures
P2xx	Preventive measures
P3xx	Response measures
P4xx	Storage related measures
P5xx	Disposal measures

Examples:

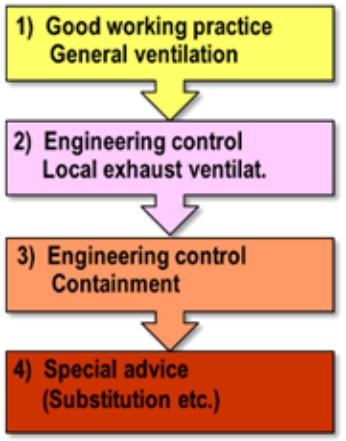
- P284 – Wear respiratory protection
- P321 – Specific treatment (see … on this label)
- P403 – Store in a well-ventilated place

6.2. CONTROL EXPOSURE AND RELEASES

FIND INFORMATION ON RECOMMENDED CONTROLS

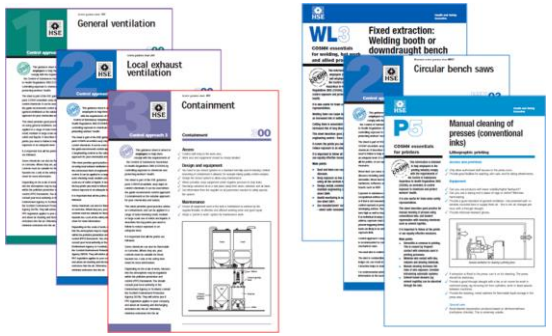
When implementing the control banding methodology for risk assessment (see section 3.2), you will be guided towards identifying a specific control approach for each chemical and situation present in your company.

For each of the control approaches further information on how to control the risk situation is given in form of “Control Guidance Sheets”, either general in nature or very specific for certain common tasks such as transferring chemicals.



Refer to following links to for accessing control guidance sheets under different control banding tools:

- **ILO control guidance sheets** www.ilo.org/legacy/english/protection/safework/ctrl_banding/toolkit/icct/sheets.html
- **COSHH Control Guidance Sheets** www.coshh-essentials.org.uk



6.2. CONTROL EXPOSURE AND RELEASES

ELIMINATE HAZARDS THROUGH CHEMICAL AND PROCESS SUBSTITUTION

Stopping the use of a hazardous chemical is the most effective way forward in minimizing chemical risks. This is the main idea about the ZDHC initiative, aiming for the elimination of hazard chemicals from the textile and leather apparel supply chains.

A separate working group in the ZDHC initiative is dedicated to researching alternative to the substances and formulations listed in the ZDHC Manufacture Restricted Substances Lists (ZDHC MRSL).

Several leading chemical suppliers have already started offering so called “positive lists” of substitute chemicals complying with the requirements of ZDHC MRSL and other lists. Several buyers also clearly specify which chemicals the expect their suppliers to use.

As per the ZHDC programme, you are expected

- to prepare an action plan outlining how and by when you will be eliminating the ZDHC MRSL listed substances from your production.

Practical tips

- Contact your chemical suppliers to provide you with their „positive list“ chemicals.
- Several chemical suppliers also offer technical guidance on how to adapat your recipes and process controls to the chemicals.
- Check with the website of ZDHC www.roadmaptozero.com for their latest Chemical Guidance Sheets or their „Gateway“ database for better sourcing decisions.

6.2. CONTROL EXPOSURE AND RELEASES

ELIMINATE HAZARDS THROUGH CHEMICAL AND PROCESS SUBSTITUTION

There may be still practical limitations to substituting all hazardous chemicals you may use in your company. Another approach is the change of process technologies applied in your company. The European Integrated Pollution Prevention and Control (IPPC) Bureau (EIPPCB) publishes sector-specific recommendations of “Best Available Technologies” (BATs) in form of Reference documents (BREFs).

Each BREF document generally gives information on a specific industrial/agricultural sector in the EU, on the techniques and processes used in this sector, current emission and consumption levels, techniques to consider in the determination of the best available techniques (BAT) and emerging techniques.

The application of such BATs will help you to manage chemical risks as well as address other environmental impacts of your company.

Practical tips:

To access the sector specific BREFs for textile and leather industry, use following links:

Textile industry

http://eippcb.jrc.ec.europa.eu/reference/txt.html

Tanning/leather

http://eippcb.jrc.ec.europa.eu/reference/tan.html

6.2. CONTROL EXPOSURE AND RELEASES

ELIMINATE HAZARDS THROUGH CHEMICAL AND PROCESS SUBSTITUTION – TEXTILE SECTOR (EXAMPLES)

Process	Approach
Desizing	• Recovery and reuse of watersoluble synthetic sizing agents through ultrafiltration
Bleaching	• Use of hydrogen peroxide instead of chlorine-based bleaches
Mercerising	• Recovery and reuse of caustic soda solution from the mercerising process
Printing	• Use of optimized printing paste • Low-emission thickeners • APEO-free pigments with a high degree of bio eliminability, reduced ammonia content.
Finishing	• Replacement of halogen organic solvents (e.g. in stain removal and subsequent cleaning).

Source: Environmental Standards in the Textile and Shoe Sector, UBA, 2011
www.umweltbundesamt.de/sites/default/files/.../4289.pdf

6.2. CONTROL EXPOSURE AND RELEASES

ELIMINATE HAZARDS THROUGH CHEMICAL AND PROCESS SUBSTITUTION – LEATHER SECTOR (EXAMPLES)

Process	Approach
Unhairing	• Use of enzymatic unhairing
Deliming	• Substitution of ammonium compounds by Carbon Dioxide or weak organic acids.
Pickling	• Recovery and reuse of caustic soda solution from the mercerising process
Degreasing	• Replacement of halogenated organic solvents by using non-halogenated • solvents or by changing over to an aqueous degreasing system, use of dimethyl ether • Replacement of nonylphenol and nonylphenol ethoxylates
Tanning	• Use of high exhaustion tanning
Dyeing	• Use of polyphosphate-based and phosphonate-based complexing agents in place of EDTA (ethylenediaminetetraacetate) • Use of liquid and low dust dyes to reduce dust emissions (health issue)
Fatliquoring	• Replacement of halogenated organic compounds by fatliquoring polymers based on methacrylate; or by silicone oils or modified silicone oils. • Use of fat recycled from sheepskin degreasing in the preparation of fatliquoring agents
Finishing/cleaning	• Replacement of halogen organic solvents (e.g. in stain removal and subsequent cleaning).

Source: BREF/BAT Leather, 2013

6.2. CONTROL EXPOSURE AND RELEASES

ELIMINATE HAZARDS THROUGH CHEMICAL AND PROCESS SUBSTITUTION – TEXTILE SECTOR (EXAMPLES)

Denim production

- Replacement of Sodium hypochlorite in bleaching, or potassium permanganate for special effects by using ozone based systems or by changing over to laser system

Source: Environmental Standards in the Textile and Shoe Sector, UBA, 2011
www.umweltbundesamt.de/sites/default/files/.../4289.pdf

Photo source: GIZ PSES

6.2. CONTROL EXPOSURE AND RELEASES

ISOLATE HAZARDOUS CHEMICALS AND PROCESSES

Isolation measures aim at separating people from hazardous chemicals by distance or structural/technical barriers to prevent or minimize the chance of exposure, but also physically separating hazardous chemicals from other chemicals or installations. For example:

- Placing your spraying operations in separate work area which is structurally enclosed and fitted with exhaust extraction systems to remove contaminants
- Mixing of chemicals in a segregated well ventilated area
- Segregating incompatible chemicals during storage (see section 6.6)
- Segregating waste water flows with incompatible chemicals
- Keeping sources of ignition away from flammable chemicals

6.2. CONTROL EXPOSURE AND RELEASES

APPLY ENGINEERING CONTROLS

The next option in controlling exposure are engineering control measures which prevent the chance of exposure (skin contact, inhalation) and limit the area of releases. For example:

- Enclosing and/or encapsulating of processes with hazard chemicals and chance of releases
- Removing chemical emissions using special drainage arrangement and local exhaust ventilation (LEV) on process machinery or at point of work
- Using drainage systems and general ventilation in work areas
- Installing secondary containments in storage areas to limit contamination in case of spills and leaks
- Using waste water treatment systems before discharging waste water

Enclosed processes in textile production

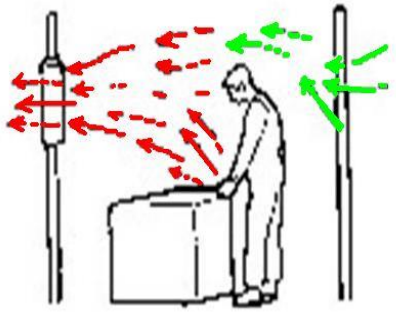
Use of local exhaust ventilation in glue application in shoe factory, Photo. AUVA

General ventilation of workfloor

6.2. CONTROL EXPOSURE AND RELEASES

SPECIAL CONSIDERATION FOR VENTILATION SYSTEMS

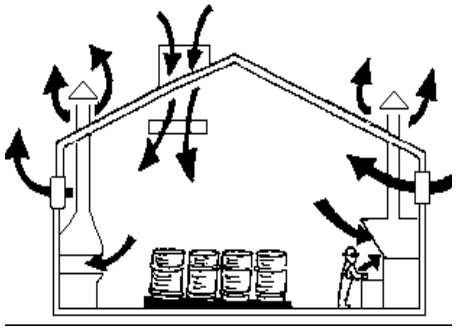
Exhaust and ventilation systems are meant to maintain a safe atmosphere by either introducing uncontaminated air or removing contaminated air. When designing such system make sure that recirculation of contaminated air is avoided. Contaminated air removed through locally exhausted ventilation systems should be cleaned by means of scrubbing or other cleaning devices before being released into the air.



clean air
contaminated air

Check in your company

- ☐ Are the stack heights maintained as per local regulation?
- ☐ Are local exhaust systems connected to operational clearning devices?
- ☐ Are there provisions to release exhaust air (luvers, vents) at the ceiling?
- ☐ Is there a chance of cross-contamination to/from other work areas, generator sets (or neighbouring factories?)



6.2. CONTROL EXPOSURE AND RELEASES

IMPLEMENT ADMINISTRATIVE CONTROLS

Administrative controls refer to measures that change the way the work is done, including timing of work, policies rules, and work practices such as standards and operating procedures, use of warning signs, training as well as personal hygiene practices.

These are not stand-alone controls but complement other higher order controls (e.g. substitution, isolation, engineering control).

Examples of administrative controls:

- Providing written work procedures and instructions
- Reducing the number of workers exposed to chemicals (e.g. limiting access to such areas or high risk areas to authorized personnel only)
- Reducing the duration and/or frequency of workers' exposure through specific work procedures (for example, job rotation)
- Prohibiting eating, drinking and smoking in potentially contaminated areas
- Providing washing facilities close to work areas with chemicals
- Following good housekeeping and maintenance practices

USEFUL LINKS FOR COMPLETING STEP 6, TASK 6.2

For further information and use ***Some useful links***		
	Local exhaust ventilation	Controlling airborne contaminants at work - A guide to local exhaust ventilation (LEV), HSE, UK,

Click on the green document icons to get further information

6.3. SELECT AND USE PERSONAL PROTECTIVE EQUIPMENT

The main purpose of personal protective equipment (PPE) is to protect employees/workers should an accident or incident occur despite appropriate management systems and operational procedures.

As such the use of PPE should be considered as the last resort once all other control options have been explored.

PPEs may be used as an interim measure where engineering controls are being developed and/or modified and for short-term jobs such as cleaning and maintenance or in emergency situations.

Commonly, PPE includes protective clothing (e.g. overalls, aprons, footwear, gloves, chemical resistant glasses, face shields) and respirators.

Engineering controls protect everyone in the workplace; a respirator can only help the person wearing it.

A PPE is the last barrier between the contaminant and you!

6.3. SELECT AND USE PERSONAL PROTECTIVE EQUIPMENT

FIND INFORMATION SOURCES AND GUIDANCE ON PPE

In order to make sure that the PPEs can effectively provide the desired protection, your employees/workers need guidance on the selection and proper use of the PPEs. Such guidelines (for example in form of a PPE procedure(may cover the following areas:

- ☐ Guidance on how to select the correct type (for the chemical in question) and suitability of personal protection equipment taking into consideration the exposure and work situation
- ☐ Clear instruction to workers on the proper use of the PPE (when, where, how)
- ☐ Guidance on storage, cleaning and maintenance of PPE
- ☐ Guidance on replacement of PPE (e.g. recommended time of use, verification of remaining protection level)

► According to ZDHC CMS 3.5.8 Personal Protective Equipment (PPE), your company is expected to develop a procedure of the PPE use.

Practical tips:

The main source of information for the selection of appropriate PPEs are the safety data sheets.

► Check section 8 in the (GHS conform) safety data sheet

6.3. SELECT AND USE PERSONAL PROTECTIVE EQUIPMENT

ENSURE ADEQUATE RESPIRATORY PROTECTION

Respiratory protection equipment protect you against exposure from airborne contaminants in form of (i) solid or liquid particles (dust, mist, aerosols), (ii) vapours and (iii) gases by inhalation and partly eye absorption (depending on type of mask).

These contaminants may either directly affect the respiratory tract, for example being irritating or impairing the lung function, or get absorbed into the body`s circulatory system, resulting in systemic effects.

The main purpose of respiratory protection equipment (e.g. dust masks) is to purify the air you breath. A special case are respiratory protection devices for use in situation with immediate danger to life and health such as in areas with oxygen-deficiency (for example in confined spaces such as tanks or vessels), which provide you with breathable air from a tank or through a supply line.

6.3. SELECT AND USE PERSONAL PROTECTIVE EQUIPMENT

ENSURE ADEQUATE RESPIRATORY PROTECTION

Overview of basic types of respiratory protective devices

Air purifying respirators (APR) use filters (for solid and liquid particulates e.g. dust, aerosols), cartridges (for gases and vapours) or canisters (used with „gas mask“). These can only be used, if the atmospheric oxygen level remains higher **than 19.5%.** Both disposable and reusable type of respirators are available and may come in form of quarter, half or full face masks.

If the atmospheric oxygen level drop below this level **atmosphere-supplying respirators or supplied-air respirators (SAR)** need to be provided. These may air supply units or self-contained breathing apparatus (SCBA).

Disposable air purifying respirator

Reusable air purifying respirator

6.3. SELECT AND USE PERSONAL PROTECTIVE EQUIPMENT

ENSURE ADEQUATE RESPIRATORY PROTECTION

Factors for consideration when selecting respiratory protective equipment:

- ☐ Is the PPE meant for routine use or non-routine use (e.g. for escape in an emergency situation)?
- ☐ What are workplace hazards the wearer of the PPE may encounter as a consequence of wearing the PPE?
- ☐ What are the physical characteristics of the wearer?
- ☐ What is the physical demand of the work (e.g. complexity of tasks, work place temperatures and humidity)?
- ☐ What are the respirator capabilities and limitations?

Type of contaminant	Characteristics
Particulate	Fine liquid or solid particles such as dust, smoke, mist or fumes found in air or emissions
Mist	Small droplets suspended in air
Dust	Minute solid particles with diameters less than 500 micrometers
Aerosol	Collection of very small particles suspended in air. The particles can be liquid (mist) or solid (dust or fume)
Fume	Vapor carrying suspended solid metal particles or liquid metal droplets
Vapor	The gaseous form of materials that are normally liquids or solids at room temperature and pressure (e.g. steam)
Gas	Gas is one of the four major states of matter, consisting of freely moving atoms or molecules without a definite shape and without a definite volume

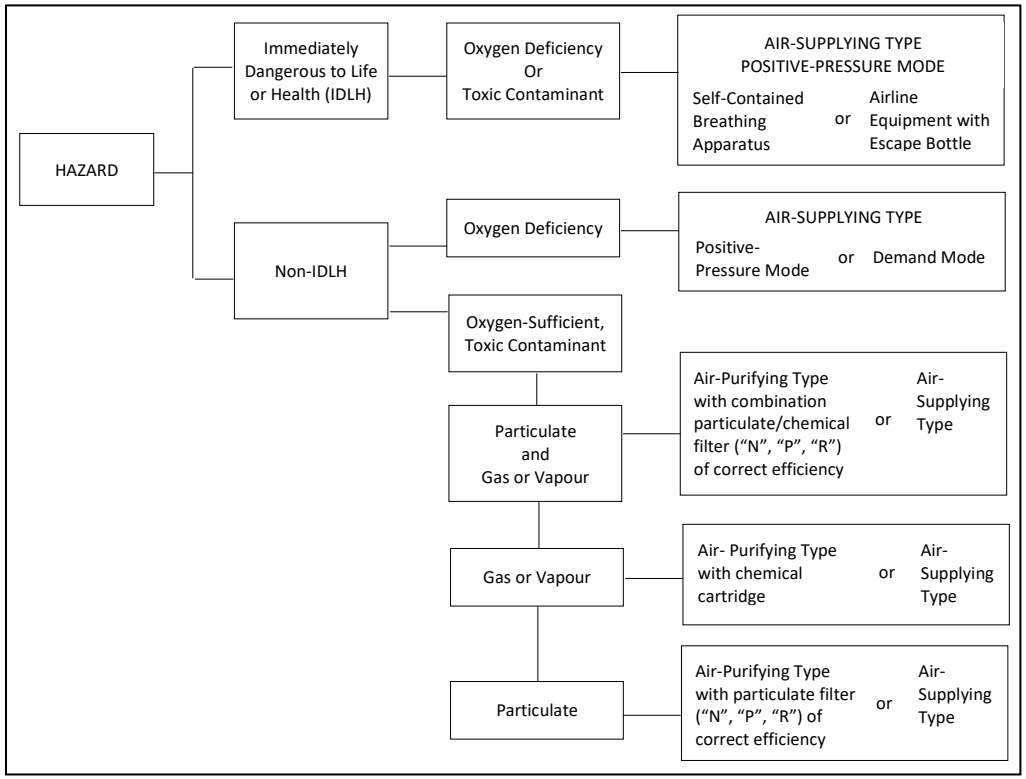
6.3. SELECT AND USE PERSONAL PROTECTIVE EQUIPMENT

ENSURE ADEQUATE RESPIRATORY PROTECTION

While selecting the respirator…

1. Identify airborne contaminants where possible
2. Match specifications and limitations of respirator
3. Consider abnormal conditions that may cause the concentration to rise

Choosing appropriate Type of Respiratory Protective Equipment



6.3. SELECT AND USE PERSONAL PROTECTIVE EQUIPMENT

ENSURE ADEQUATE RESPIRATORY PROTECTION

Match specifications and limitations of the respirator

For example:

What is the efficiency rating of the (particle) respirator?

- Efficiency ratings are given in percentage figure such as 95%, 99%, 100% (also known as HEPA) indicating the percentage of particles of certain size being filtered.

What is the resistance level to oil?

- N (not resistant to oil), R (resistant to oil), P (oil proof)

What is the required protection factor (PF)?

- Indicates up to which level of contaminant concentration the specific mask can be used

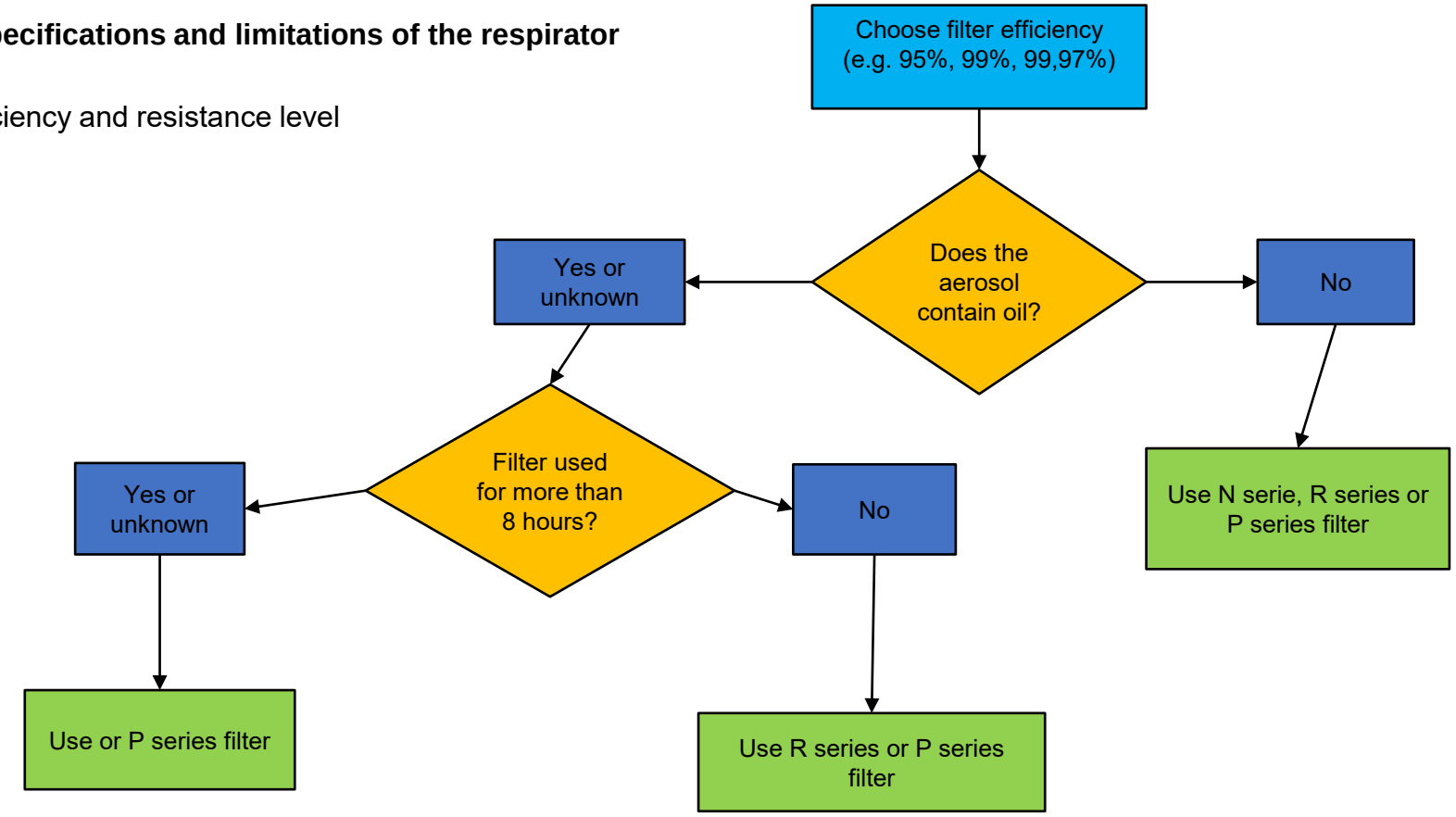
Disposable APR for solid and liquid particulates only!

6.3. SELECT AND USE PERSONAL PROTECTIVE EQUIPMENT

ENSURE ADEQUATE RESPIRATORY PROTECTION

Match specifications and limitations of the respirator

Filter efficiency and resistance level



6.3. SELECT AND USE PERSONAL PROTECTIVE EQUIPMENT

$$PF = \frac{\text{Concentration of contaminant}}{\text{Occupational exposure limit (OEL)}}$$

Example: Assigned Protection factors (APF) of common air purifying respirators

Paper Disposable APF - 5

Half-Mask APF - 10

Full-Face (FF) APF - 50

ENSURE ADEQUATE RESPIRATORY PROTECTION

Determining the required protection factor (PF)

For determining the required protection factor, the likely concentration of the expected concentration of the contaminant in the workplace air is divided by the applicable exposure limit. For example:

- Contaminant concentration in ambient air = 500 mg/m3
- OEL = 10 mg/m3
- Required protection PF = 500/10 = 50

Once you have established the protection factor you can check the rating of your mask.

6.3. SELECT AND USE PERSONAL PROTECTIVE EQUIPMENT

SELECTING AND USING RESPIRATORY PROTECTION

Practical tips:

The cartridges for reusable respirators are colour coded to indicate for which chemical (groups) they can be used.

Example:

Reusable APR with cartridges suitable for sulphur dioxide and hydrogen chloride

Color code	Filter / cartridge type	for which chemicals indicated
	AX	Gases and vapor of organic compounds with boiling point > 65 °C
	A	Gases and vapors of organic compounds with boiling point < 65 °C
	B	Inorganic gases and vapors e.g. chlorine. hydrogen sulphide, hydrogen cyanide
	E	Sulphur dioxide, hydrogen chloride
	K	Ammonia
	CO	Carbon monoxide
	Hg	Mercury vapor
	NO	Nitrous gases including nitrogen monoxide
	Reactor	Radioactive iodine including radioactive methyl iodide
	P1 -P3	Particles

Check the colour coding of the respective APR manufacturer!

6.3. SELECT AND USE PERSONAL PROTECTIVE EQUIPMENT

SELECT AND USE RESPIRATORY PROTECTION

For additional considerations

Be aware of the life time of cartridges and filters and plan for replacement!

The lifetime of the cartridges and filters depend on intensity and conditions of use (e.g. humidity, temperature). Check also the recommended service life indicators for cartridges and canisters.

Make users aware of how they can verify filter or cartridge break-throughs (e.g. odor, smell, irritation).

Make sure, that replacement of PPE (Personal Protective Equipment) at recommended intervals is planned and budgeted for.

6.3. SELECT AND USE PERSONAL PROTECTIVE EQUIPMENT

ESTABLISH A FRAMEWORK FOR RESPIRATORY PROTECTION

Your company may be required to establish a written respiratory protection program that describes the proper procedures for selecting and operating respiratory protective equipment. The correct use of a respirator is just as important as selecting the proper respirator or the appropriate filters. The respirator program outlines how to identify the existing hazards and the level of protection needed. It also describes how to wear and look after the respirator.

Elements of a respiratory protection program

- ☐ Written work site specific operating procedures
- ☐ Exposure assessment (nature of hazardous material, frequency and duration of exposure, route of entry, workers' tasks and workplace design)
- ☐ Medical evaluation of respirator wearers (to attest medical and psychological fitness)
- ☐ Procedure for proper selection of respiratory protective equipment
- ☐ Procedure for proper selection of filters/cartridges for particulates and gases
- ☐ Training of respirator users and other concerned persons
- ☐ Respirator fitting
- ☐ Cleaning, inspection, maintenance and storage
- ☐ Program evaluation (to document possible improvements)

6.3. SELECT AND USE PERSONAL PROTECTIVE EQUIPMENT

TRAIN USERS ON RESPIRATORY PROTECTION

Everyone who is involved in the use of respiratory protective equipment (RPE) needs to be appropriately trained. The users must be aware of why the respirator is being worn, which respirator should be used and how it should be worn properly. Training may be available from the supplier or manufacturer of your RPE.

A qualified person, knowledgeable of respiratory protection and workplace contaminants, must instruct supervisors as well as the person issuing respirators. Adequate training should be provided to ensure proper respirator use. It should also cover other issues such as health hazards, work practices, use of other equipment on site and medical surveillance requirements (especially for emergency and rescue teams). All workers need to be trained prior to the use of a respirator.

This training should be repeated at least once a year.

Minimum content of respiratory protection training

- What are the hazards and effects of contact with chemical?
- What are the limitations of personal protective equipment?
- When and how to use the personal protective equipment?
- When and how to clean or dispose of personal protective equipment?

Do you, the managers and supervisors act as role models for good personal protective practices in your company by following the same requirements?

6.3. SELECT AND USE PERSONAL PROTECTIVE EQUIPMENT

ENSURE ADEQUATE PROTECTION OF SKIN AND EYES

As in the case of respiratory protective equipment, the safety data sheet (see section 8) will provide guidance on what type of personal protective equipment for skins and eyes may be required when handling the specific chemical.

A good safety data sheet will not only indicate the type of personal protective equipment, but also the recommended material.

The exposure to chemicals may directly affect the skin or eye, for example in case of chemicals with corrosive or irritant hazards, or result in systemic effects when absorbed through skin and eyes.

6.3. SELECT AND USE PERSONAL PROTECTIVE EQUIPMENT

ENSURE ADEQUATE PROTECTION OF SKIN AND EYES

Be aware of limitations of protective materials

- **Permeation rate** (rate at which chemical moving through the material
- **Breakthrough time** (duration of chemical to permeate completely through the material)
- **Degradation** (physical deterioration of material due to contact with a chemical e.g. getting stiffer or softer, brittle, weaker,…)

Factors for consideration when selecting suitable skin protection

► Check task and task requirements (flexibility, grip and touch sensitivity needed)

► Identify all hazards e.g. list of the chemicals, physical hazards (e.g. abrasion, tearing, puncture, fire/flames, temperature) as well as effects of skin exposure

► Determine type of contact (e.g., occasional contact or splash protection or continuous immersion of hands) and contact period

► Consider what hazards may be presented by the use of the protective clothing itself. For example, protective clothing can contribute to heat stress; reduced dexterity; rip or tactile functions; poor comfort; or may contribute to skin conditions.

► Consider decontamination and disposal procedures.

USEFUL LINKS FOR COMPLETING STEP 6, TASK 6.3

For further information and use ***Some useful links***		
	Respiratory protection	Respiratory protective equipment at work, Guideline by HSE, UK HSG53
	Skin protection	Managing skin exposure risks at work, Guideline by HSE, UK, HSG26

Click on the green document icons to get further information

6.4. PROVIDE TRAINING, PROCEDURES AND INSTRUCTIONS

Based on the training needs assessment (see section 5.3), the implementation and continued application of good practices in your company will require the transfer of knowledge, skill and possible change in behaviors and attitudes of all person concerned.

Learning objective or subjects / Job title	Chemical hazard and exposure awareness	Recognise chemical labels and safety signs	Follow safe work practices as per work instructions	Use of personal protective equipment	Use safety data sheets	...
Production manager		•			•	
Production supervisor	•	•	•	•	•	
Store personnel	•	•	•	•	•	
ETP staff	•	•	•	•		
Worker area 1	•	•	•	•		
Worker area 2	•	•	•	•		
EHS Officers	•	•	•	•	•	
Admin.		•			•	
.....						

Formal training, for example orientation, induction and refresher, for-the-job, on-the-job training) is only one element to achieve that, complemented by initiatives such as

- assignment of clear roles and responsibilities (e.g. inclusion of chemical management related subjects into job descriptions, (see section 5.2),
- provision of written work/operating instructions
- supervision and feedback, performance ratings, and awareness campaigns,

which help anchoring chemical management and developing a suitable chemical management (safety) culture in your company.

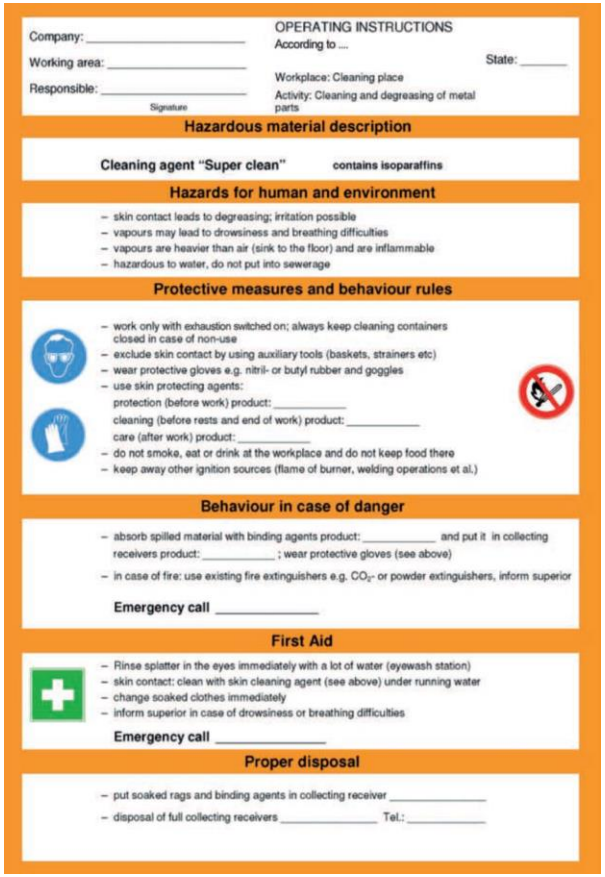
6.4. PROVIDE TRAINING, PROCEDURES AND INSTRUCTIONS

PREPARE WORK INSTRUCTIONS

For chemical handling activities written operating instructions should be available. The workers will be trained and guided by their supervisors on the basis of these work/operating instructions.

The content of the operating instructions/ manuals/ guidelines and related training need to specifics situation or chemicals, or groups of chemicals with similar properties; recommended content:

- ☐ Description and labelling of hazardous chemicals.
- ☐ Hazards and risks associated with the chemicals being handled
- ☐ Technical, organizational and personal protection measures and rules for safe behavior.
- ☐ Emergency procedures, for instance, instructions in the event of a leakage or a fire as well as first-aid measures.
- ☐ Disposal of waste products.



Company: _____ OPERATING INSTRUCTIONS

Working area: _____ According to ...

Responsible: _____ State: _____

Signature

Workplace: Cleaning place

Activity: Cleaning and degreasing of metal parts

Hazardous material description

Cleaning agent "Super clean" contains isoparaffins

Hazards for human and environment

- skin contact leads to degreasing; irritation possible
- vapours may lead to drowsiness and breathing difficulties
- vapours are heavier than air (sink to the floor) and are inflammable
- hazardous to water, do not put into sewerage

Protective measures and behaviour rules

- work only with exhaustion switched on; always keep cleaning containers closed in case of non-use
- exclude skin contact by using auxiliary tools (baskets, strainers etc)
- wear protective gloves e.g. nitril- or butyl rubber and goggles
- use skin protecting agents:
  protection (before work) product: _____
  cleaning (before rests and end of work) product: _____
  care (after work) product: _____
- do not smoke, eat or drink at the workplace and do not keep food there
- keep away other ignition sources (flame of burner, welding operations et al.)

Behaviour in case of danger

- absorb spilled material with binding agents product: _____ and put it in collecting receivers product: _____ ; wear protective gloves (see above)
- in case of fire: use existing fire extinguishers e.g. CO_2- or powder extinguishers, inform superior

Emergency call _____

First Aid

- Rinse splatter in the eyes immediately with a lot of water (eyewash station)
- skin contact: clean with skin cleaning agent (see above) under running water
- change soaked clothes immediately
- inform superior in case of drowsiness or breathing difficulties

Emergency call _____

Proper disposal

- put soaked rags and binding agents in collecting receiver _____
- disposal of full collecting receivers _____ Tel.: _____

Source: ISSA, Storage of Chemicals

6.4. PROVIDE TRAINING, PROCEDURES AND INSTRUCTIONS

ORGANISE TRAINING AND LEARNING

Key factors which facilitate learning in adults

- **Motivation**. Since learning is an individual experience, adults must want to learn and must perceive the relevance of what they learn to their personal interest.
- **Seeing and hearing** Adults tend to learn best when they can see, hear and actively work on what is being taught. This means that training should include accompanying visual material, videos, posters and slides.
- **Practice.** The opportunity to practice what is being taught intensifies learning. When a skill is being taught (for example, the correct fitting of a respiratory) learners should be allowed to exercise it for themselves. Where the objective is applied knowledge, problem-solving exercises can be used. “Experiential” exercises whereby learners actually experience the application of abstract concepts such as teamwork are valuable instructional tools.
- **Relationship to practical experience**. Learning is facilitated when the training material and content can easily be related to the practical experience of the learners. This suggests that examples used should, as far as possible, relate to the industry processes familiar to the learners.

Source: ILO Encyclopaedia, Principles of Training

6.4. PROVIDE TRAINING, PROCEDURES AND INSTRUCTIONS

KEY FACTORS WHICH FACILITATE LEARNING IN ADULTS

Key factors which facilitate learning in adults

- **Participation in the learning process**. Adults should know from the start what the learning objectives are and be given the opportunity to test the lesson content against these objectives.
- **Feedback**. Adults need feedback on their own results (how well they are doing) and positive reinforcement.
- **Trying out ideas**. The opportunity to try out and develop ideas is part of the individual process of internalizing new information and its application. This can be achieved through small peer group discussions.
- **Physical environment**. The training facility and equipment should be sympathetic to the learners, allowing them, for example, to see visual material and to work effectively in small groups.

Source: ILO Encyclopaedia, Principles of Training

USEFUL LINKS FOR COMPLETING STEP 6, TASK 6.4

For further information and use ***Some useful links***		
	Work instruction	Sample template for preparing task specific work instructions
	Training guidelines	Practical tips for organising effective training in your factory
	Chemical safety for your staff	Training kit of International Labour Organization (ILO) on chemical safety, http://actrav.itcilo.org/actrav-english/telearn/osh/kemi/scan/sandhm.htm

Click on the green document icons to get further information

6.5 IMPROVE CHEMICAL HANDLING

Good housekeeping (or “good and basic general practices”) refer to a number of practical measures, often based on common sense, that you company can implement to improve productivity, obtain cost savings, and reduce environment, health & safety impacts of your production. “Good housekeeping” is more of a habit than a technique aiming at

- Rationalizing the use of raw materials, chemicals, water and energy inputs
- Reducing the volume and toxicity of waste, waste water and emissions
- Conserving materials and energy
- Improving working conditions and occupational safety & health.

The implementation of such measures is usually relatively easy and often of low-cost nature.

6.5 IMPROVE CHEMICAL HANDLING

MINIMIZE/OPTIMIZE THE CHEMICAL USE

Check your recipes regularly in order to identify and avoid superfluous chemical volumes. At the same time improved the knowledge of chemicals and raw materials used, for example prescreening of incoming raw materials (fibres, chemicals, dyestuffs, auxiliaries, etc.) is of importance for not only pollution prevention but also conformance to ZDHC MRSL requirements.

Also optimizing scheduling in production (e.g. in dyeing: dyeing dark shades after pale shades reduces water and chemicals consumption for machine cleaning)

The application of concepts such as “Right-first-time” (RFT), Six Sigma, or 5S will help to create to optimize that set up and develop corresponding efficiency culture.

Photo: Hannak J., bfz- Espire Green

6.5 IMPROVE CHEMICAL HANDLING

PAY ATTENTION TO EQUIPMENT MAINTENANCE AND OPERATIONS AUDIT

Take a closer look in your company:

- Are the machinery, pumps and pipework (including abatement systems) well maintained and free from leaks?
- Are regular maintenance schedules established, with all procedures documented.

Pay particular attention to the following areas:

- **Machinery checking**: Are the most significant components of the machinery like pumps, valves, level switches and pressure and flow regulators included in a maintenance checklist?
- **Leak control**: Are audits conducted and reporting systems in place for broken and leaking pipes, drums, pumps and valves, not only in the water system but also from the oil heat transfer and chemicals dispensing systems

Attending to leaking valves and pipe connections of a chemical dosing system

6.5 IMPROVE CHEMICAL HANDLING

PAY ATTENTION TO EQUIPMENT MAINTENANCE AND OPERATIONS AUDIT

Attention to calibration and dosing

Careful and regular calibration of measuring equipment, such as chemicals measuring and dispensing devices, thermometers etc. can contribute to significant savings of chemicals and reduction of chemical non-product outputs. Accurate weighing, dispensing and mixing are fundamental to avoiding/minimizing spillage in manual operation.

An automated chemical dosing and dispensing system offers some important advantages over the manual method (better laboratory-to-dye house correlation; minimizes the chance of worker injury when handling hazardous chemicals; faster delivery times, etc.)

Little measures with a big impact

As part of effort of assisting textile industry in process control and optimization in textile wet processing, the chemical supplier Huntsman engaged with several textile manufactures in Bangladesh to review their laboratories and practices in preparing their dye recipes. On average the laboratory weighing scales and digital pipettes were found the be off by 1.2 – 2.4%.

For dyeing of one ton fabrics of medium shade, this would translate into saving up to 0.5 kg of dye stuff, not yet taking into account the environmental management costs.

6.5 IMPROVE CHEMICAL HANDLING

ENSURE ADHERENCE TO SIMPLE DAY-BY-DAY PRACTICES

- Repair all broken seals of chemical containers to avoid vapors from escaping. Ensure that the lids of all chemical containers are tightly closed.
- Inspect packaging of materials to make sure that it is not damaged during delivery and storage. Return poorly packaged and/or deteriorated chemicals to suppliers.
- Apply first, first storage practices to avoid waste of chemical due to spoilage during storage or exceeding of shelve life.
- Regularly inspect and keep the storage area clean to avoid any contamination of materials. Immediately clean up any spillage to pre-vent accidental mixtures that could lead to ignition or explosion
- Instruct workers to avoid using the same tools (e.g. cups, scoops, buckets) for measuring and removing different materials in order to avoid contaminating stored chemicals
- When cleaning dry chemicals and chemical containing dust, consider the use of vacuum cleaned devices, instead of broom and brushes to avoid their dispersal into the workplace air.

Source: GIZ PSES

6.6 SAFE CHEMICAL STORAGE

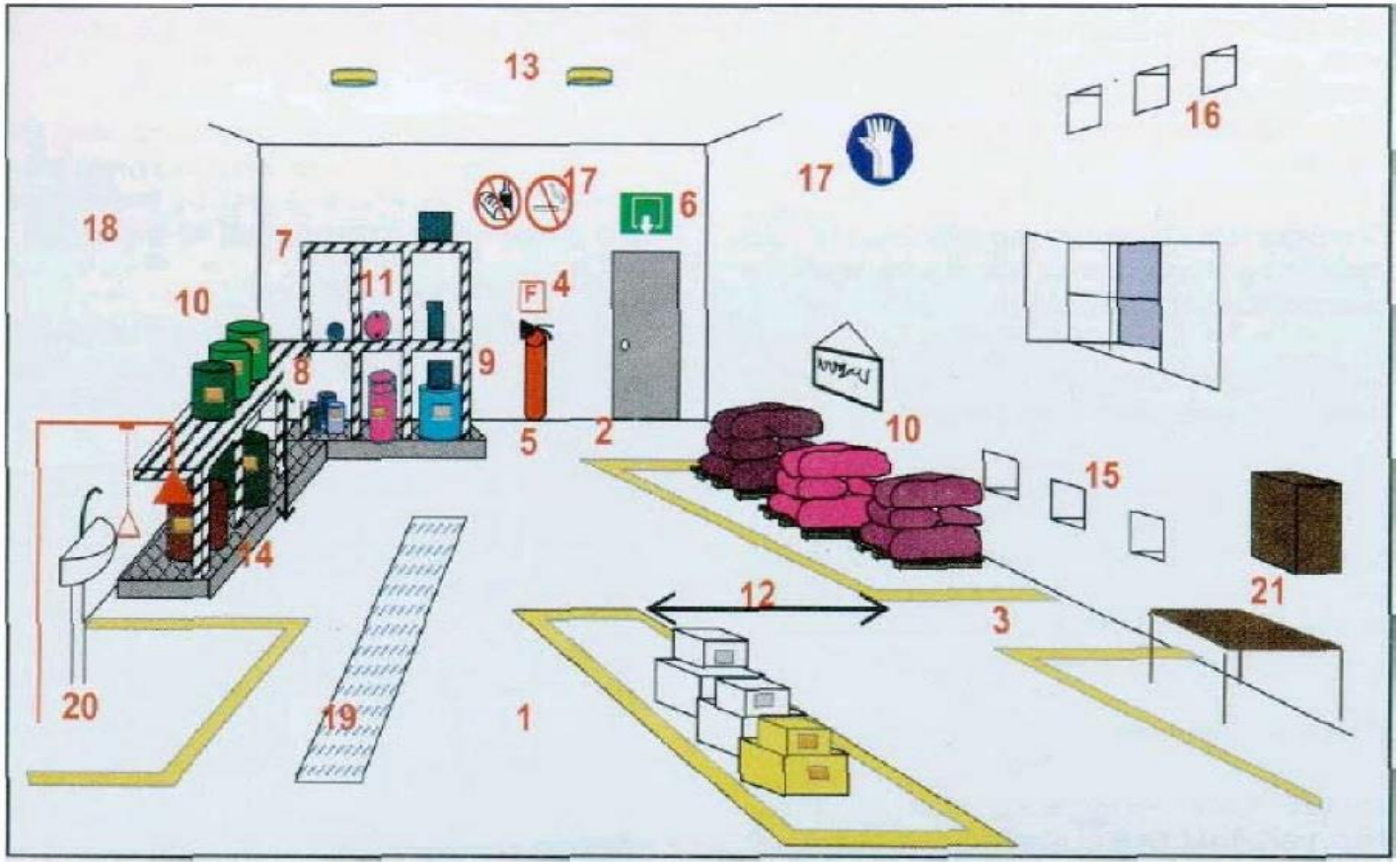
The safe storage of (hazardous) chemicals is another important stage of the lifecycle of chemicals in your company. Chemical storage facilities must meet certain minimum standards to ensure a safe (but also efficient) handling of chemicals in order to maintain the workers` health and minimize the risk of safety, health and environment.

Areas of attention

- Structure, layout and size of chemical store
- Finding the right storage space for each chemical
- Safe storage and handling practices
- Emergency provisions

6.6 SAFE CHEMICAL STORAGE

For explanatory notes with regard to the numbered areas in the drawing refer to the following pages



6.6 SAFE CHEMICAL STORAGE

STRUCTURE, LAYOUT AND SIZE OF CHEMICAL STORE

Adequate storage facilities are a pre-requisite for safe storage. Check your local regulations for specific requirements regarding factors location, structural make, fire resistance and protection.

☐ No. 18* - Generally it is recommended that the chemical store is physically separated from production areas, occupied buildings . Other storage areas (e.g. raw material, semi-finished, finished products), workshops or areas with potential sources of ignition (e.g. generator, boiler, electrical transformers and control panels). The location should be selected in such a way that the store may not be subjected to flooding.

☐ No. 1 - The floor of the chemical store is flat (to allow easy handling of chemical containers with trolleys, forklifts,..) and non-permeable to prevent contamination of soil and ground-water from chemical spills. In case of an elevated location the storage areas is accessible by outside ramps; mezzanine floors are provided with a hoisting arrangement to minimize need of manual handling.

☐ No. 2 – The store has at least separate unobstructed and clearly marked (no. 6) emergency exits. However, at all times, unauthorized personnel must be prevented from entering the chemical store. The main doors should lockable. In addition, signboards are placed outside the entrances, clearly marking the building or areas as chemical store and prohibiting unauthorized entry.

☐ No 13 - Electrical installation inside the chemical store (e.g. switches, panels, light fittings, cables) are insulated and be “explosion proof”. Ideally, switches are placed outside the chemical store. Regular and emergency lights are available and sufficient to allow for easy identification of chemicals.

☐ No 15 and 16 - Exhaust vents at floor and ceiling level help to maintain temperature and humidity at recommended levels and allow possible air contaminants (heavy and light vapors, dusts) to removed from the storage area.

***compare the numbers with the numbering in drawing on the previous page**

6.6 SAFE CHEMICAL STORAGE

FIND THE RIGHT STORAGE SPACE FOR EACH CHEMICAL

For placing the chemicals in your chemical store, group chemicals according to their type and **compatibility** (see next page on checking compatibility). Also take into consideration **maximum permissible** or **recommended quantities** for certain classes of chemicals.

☐ No. 3 – Different areas are clearly designated for the storage of the different chemicals.

☐ No. 12 – The designated storage areas are separated from each other to allow for easy movement of personnel and movement devices (e.g. trolley, forklift). This movement areas are clearly marked. Recommended width of passageways: 0.8 meters (about 2 feet) for persons, 2 meters (6 feet) for trolleys and forklifts.

☐ No. 3 - Avoid the storage of powered chemicals which are kept in bags directly on the floor to protect against ground humidity. Placement on pallets will allow for easy movement of chemicals with trolleys or forklifts.

☐ No. 9 – Containers with liquid chemical (for any with more than 5 liters) are kept in catch-pits (trays) and/or areas with structural secondary containments. If not otherwise regulated, such secondary containment system should have sufficient capacity to contain at least 100% of the volume of the largest container stored.

☐ No. 14 - Racks and shelves increase the available storage space. Make sure that the quantity store that way does not exceed the recommended structural capacity of the shelves and rack system. Considering ergonomic aspects, smaller and lighter chemical containers (with for powdered chemicals) can be stored on higher shelves. Heavier chemical containers, particularly those containing liquid chemicals should be stored at the floor level.

☐ No. 10 - For clear identification of the chemicals, make sure that each chemical container is clearly labelled (see section 3.1 GHS labelling). In addition, each designated chemical storage area is labelled indicating at least type of chemical family and hazards classification.

☐ Storage cabinets, if in use, are of approved quality, lockable and clearly labelled with the hazard class of the chemicals.

***compare the numbers with the numbering in drawing on the previous page**

6.6 SAFE CHEMICAL STORAGE

CHECK COMPATIBILITY AND STORAGE CLASSES OF CHEMICALS

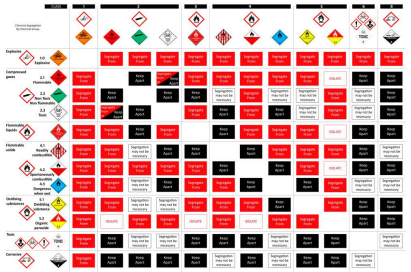
Accidental contact between incompatible chemicals can result in fire, explosion and/or formation of highly toxic or otherwise dangerous mixtures. Therefore, such contact has to be prevented through segregation, either by storing in separate areas or by structural separation (e.g. divider walls, separate storage area).

Before actually placing the chemicals in your chemical store

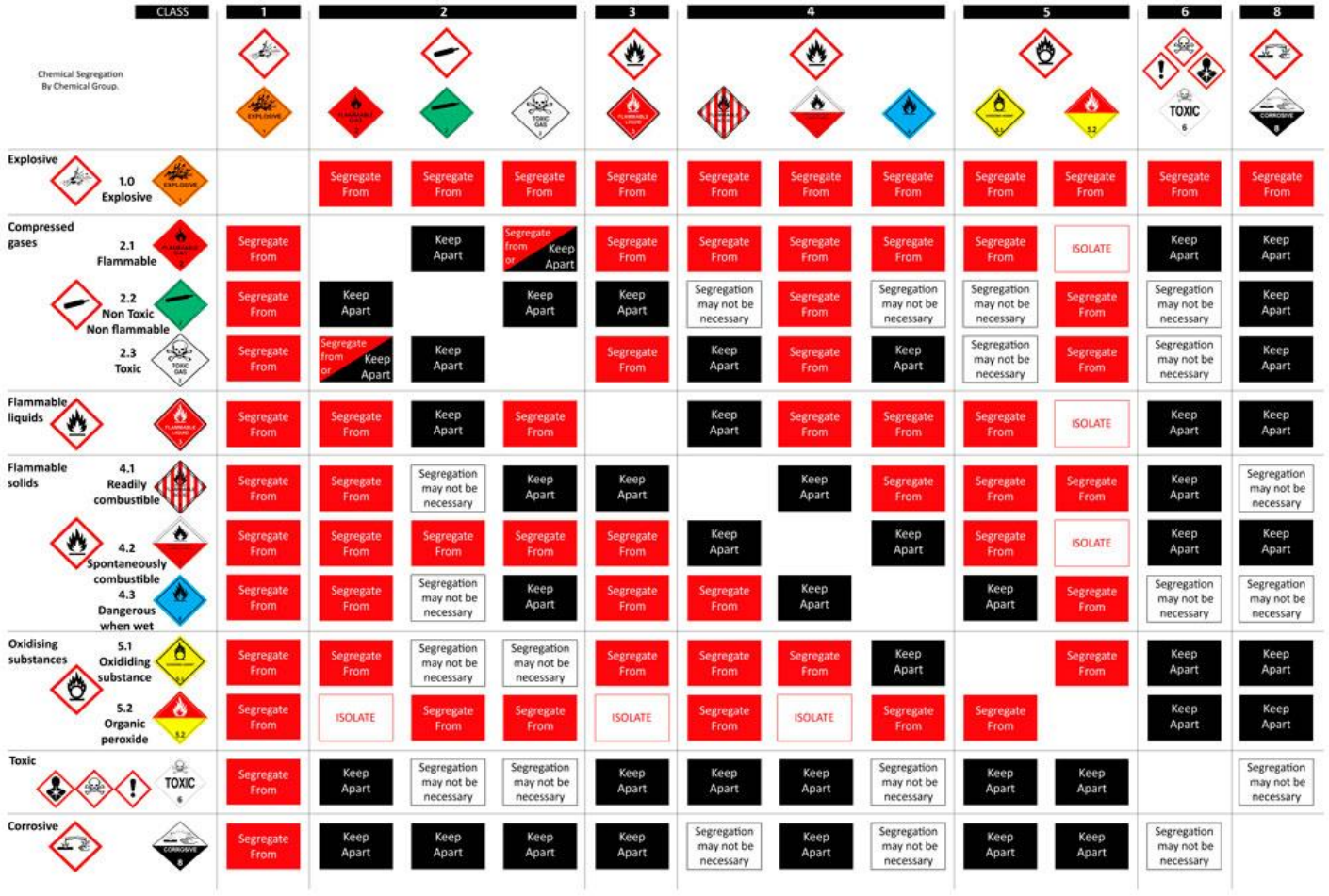
- consult chemical inventory on all chemicals to be kept in the store.
- consult the safety data sheets (see GHS SDS section 7) or technical guideance sheets regarding the storage recommendations. This section contains specific guidelines for storge (e.g. temperature, humidity) as well as information regarding **compatibilty** and **incompatibity** with other chemicals.
- prepare a chemical storage plan.

Practical tips

Example of chemical segregation charts, see next page



6.6 SAFE CHEMICAL STORAGE



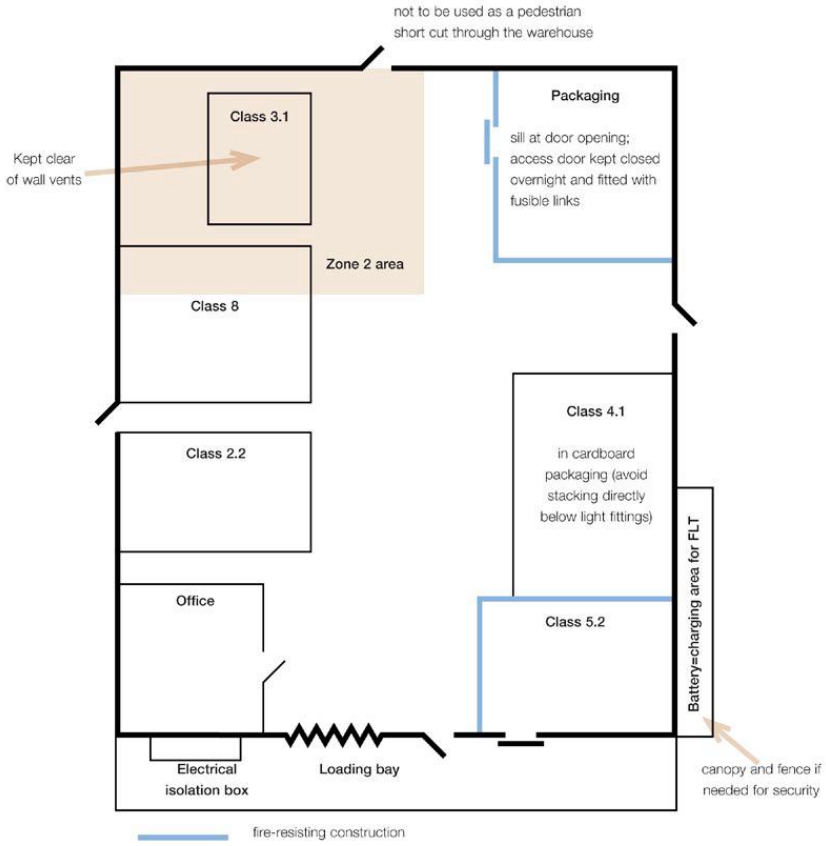
Chemical segregation chart (Example)

6.6 SAFE CHEMICAL STORAGE

FOLLOW SAFE STORAGE AND HANDLING PRACTICES

For placing the chemicals in your chemical store group chemicals according to their type and compatibility.

- ☐ No chemicals containers are stored outside the designated areas or in designated passageways.
- ☐ No. 21 – Reference information of all chemicals stored (e.g. a set of safety data sheets) are kept for ready reference in the chemical store. In case of emergency, these provide valuable and often life-saving information to emergency personnel (first aid, doctor, fire fighter).
- ☐ No. 17 – Precautionary and warning signs in the chemical store help to create awareness and provide guidance on preventive (e.g. no smoking, not eating, no open flames) and precautionary measures (e.g. type of PPE to be worn)
- ☐ The chemical containers are kept closed unless you are dispensing a chemical.
- ☐ Use separate spatulas and measuring cups to avoid cross-contamination of your process chemicals.



Source: HSE-HSG 71

***compare the numbers with the numbering in drawing on the previous page**

6.6 SAFE CHEMICAL STORAGE

ENSURE EMERGENCY PROVISIONS IN THE CHEMICAL STORE

- ☐ No. 4 and 5 – Fire extinguisher, suitable for the type of chemicals stored (check with your safety data sheet!), are kept ready in easily and clearly marked locations. Ideally, suitable fire extinguishers are placed outside the chemical store as well.

- ☐ No. 20 - A washing facility, eye/face rinsing station or safety shower are available in or near the chemical store for personal hygiene (after handling chemicals) and emergencies.

- ☐ No. 21 - The first aid kit is readily available in the work area. Check with the safety data sheet what additional items should be place in first aid box.

- ☐ Spill control material (absorbent material, waste receptacles, emergency personal protective equipment) are kept ready. Select the absorbent and spill control material as per the recommendations in the safety data sheets. Any spills or leaks are cleaned up immediately. Chemical run-downs into sinks, floors or storm water drains are prevented.

- ☐ In earthquake prone areas, shelves should have raised edges or rim guards (minimum height 5 cm) to prevent containers from falling of the shelves. You can use cords for added security.

***compare the numbers with the numbering in drawing on the previous page**

USEFUL LINKS FOR COMPLETING STEP 6, TASK 6.6

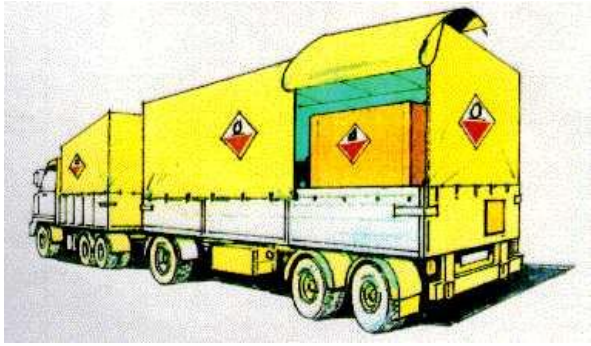
For further information and use ***Some useful links***		
	HSE HSG 71 – Chemical warehousing	Guidance book on chemical warehousing, Health and Safety Executive, UK (HSE) http://www.hse.gov.uk/pubns/priced/hsg71.pdf
	ISSA – Storage of chemicals	Storage of chemicals - Guidelines for good practice, International Social Security Association (ISSA) www.issa.int/en_GB/web/prevention-chemistry/resources

Click on the green document icons to get further information

6.7 SAFE CHEMICAL TRANSPORT

For the establishment of procedures and practices on the safe transport of chemicals (and waste) take a look at following areas:

1. Transport of chemicals and chemical waste to/from your company
2. Receiving and unloading of chemicals
3. Internal transport and conveyance of chemicals and waste (e.g. transport to warehouse, from warehouse to production areas, within production areas,…)



Source: ILO-CIS

6.7 SAFE CHEMICAL TRANSPORT

ENSURE SAFE EXTERNAL TRANSPORT OF CHEMICALS AND WASTE

In connection with your purchasing policy and practices (see section 6.1.) verify by whom and by which means of transport the chemicals are being delivered to the enterprise. In case the chemicals are being delivered by the chemical supplier, ensure that the purchase order includes a clause demanding that the supplier meets the national regulations outlining the requirements for safe transport of dangerous/ hazardous goods (e.g. hazardous chemicals, chemical waste).

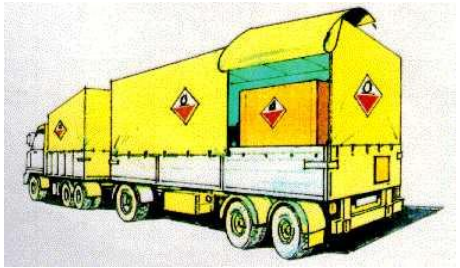
Aspects to consider:

(1) **making and labeling of packages** to indicate the hazards of the consignment, through inclusion of information in transport documents, placing of placards on the transport containers and vehicles (refer to national legislations and/or UN Recommendations on the Transport of Dangerous Goods)

(2) **vehicle requirements** such transport documents, transport emergency card (instructions in case of an accident or emergency), driver's training and qualifications (e.g. clearance for driving vehicles transporting hazardous goods), condition of vehicle, emergency provisions on vehicle

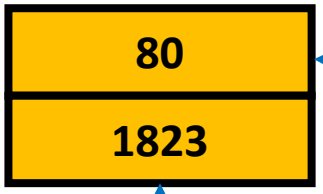
(3) **loading requirements** with regard to quantity, mixing with other loads (e.g. compatibility issue)

6.7 SAFE CHEMICAL TRANSPORT



ENSURE SAFE EXTERNAL TRANSPORT OF CHEMICALS AND WASTE

For example: Labels and placard on vehicle transporting caustic soda flakes to your company:



Substance identification code as assigned by the United Nations Committee of Experts on the Transport of Dangerous Goods

ADR Kemler Code

First figure identifies primary hazard

2 Gas	**5** Oxidising substance
3 Flammable liquid	**6** Toxic substance
4 Flammable solid	**8** Corrosive

The second and third figure indicate secondary hazards

0 First digit adequately describes hazard

2 Gas may be given off	**6** Toxic risk
3 Fire risk	**8** Corrosive risk
5 Oxidising risk	**9** Risk of violent reaction

X = Reacts dangerously with water

Where the first and second digit are the same, an intensification of the primary hazard is indicated. For example 33 indicates highly flammable.

Blank plates (without any numbers) are displayed when the vehicle is carrying carrying dangerous load (drums, packages, etc.).

Check section 14 of your SDS for information on required numbering and labels.

6.7 SAFE CHEMICAL TRANSPORT

ENSURE SAFE EXTERNAL TRANSPORT OF CHEMICALS AND WASTE

Are following documents are available…

- ☐ Transport document (letter of consignment)?
- ☐ Declaration that the packing and labelling properly done?
- ☐ Transport emergency card (instructions in writing in case of accident or emergency that may occur during transport)?
- ☐ Driver's training certificate for transporting hazardous goods?
- ☐ Certificate of approval given by technical inspection for the tank and vehicle?
- ☐ Labels and placards (in line with chemicals being transported)?
- ☐ Packing certificate of the container ?

Is every transport unit carrying dangerous goods equipped with…

- ☐ Fire-fighting appliances (chosen according to the type of load)?
- ☐ Tool kit for emergency repairs to the vehicle?
- ☐ At least one scotch (mechanical brake) of a size suitable for the weight of the vehicle and the size of the tyre?
- ☐ Two amber lights independent of the electrical system of the vehicle
- ☐ Placards, according to the transported goods?
- ☐ Protective equipment (for personal protection, absorbing material for spills, etc.)

6.7 SAFE CHEMICAL TRANSPORT

ARRANGE FOR SAFE INTERNAL TRANSPORT AND CONVEYANCE OF CHEMICALS AND WASTE

During the transport and distribution of containers, care must be taken to ensure that valves and connections are not damaged. Adequate precautions should be taken to prevent cylinders from falling off the vehicle and from being subjected to rough usage, excessive shocks or local stress, and to prevent excessive movement of liquids in large tanks.

Every vehicle should be equipped with a fire extinguisher and an electrically conductive strip for earthing static electricity, and should be clearly marked “Flammable liquids”. Exhaust pipes should have a flame-control device, and engines should be halted during loading and unloading. The maximum speed of these vehicles should be rigorously limited.

Provide carts, trolleys, and other simple transport devices to move materials in order to avoid accidents and spillage that can easily occur during manual carrying.

6.7 SAFE CHEMICAL TRANSPORT

ARRANGE FOR SAFE INTERNAL TRANSPORT AND CONVEYANCE OF CHEMICALS AND WASTE

Certain chemicals may be conveyed through pipe systems inside your factory. Establish a standard colour coding system to allow everybody in your factory to clearly identify what the respective pipe may contain. Failure to correctly identify the service of a pipe work system can and often has been shown to be the cause of plant upsets and safety incidents.

Check what specific colour coding system is in use in your country.

Example for colour coding of pipes

Pipe content	Color
Fire quenching fluids	
Potable, cooling, boiler feed and other water	
Toxic & corrosive fluids	
Flammable fluids	
Combustible fluids	
Compressed air	
Waste water	

6.8 PLAN AND PREPARE FOR CHEMICAL EMERGENCIES

Emergencies with chemicals can have catastrophic effects not only for workers but also for the community at large and the environment.

Pre-emergency planning not only gives clear guidance to everyone in the enterprise as to what and what not to do, but it also provides an excellent opportunity for discussion with fire, police, medical and other emergency services outside the plant.

Management should establish emergency measures and facilities to deal with any eventuality. For example, in case of an accidental splash or contact with chemicals, emergency showers and eye-wash points should be pro-vided in close proximity to the workstation. These facilities should be regularly inspected to ensure that they are in operation when needed.

Common emergency situations involving chemicals

- Fire or explosion (e.g. warehouse, disposal yard, production area)
- Fire producing harmful gases or mixtures
- Medical emergency (e.g. poisoning, burns, asphyxiation e.g. in confined spaces)
- Spill, rupture and leak from chemical containers, dosing or conveyance systems
- Leaks from effluent treatment plant
- Flooding of chemical store
- Vehicular accidents during transport of chemicals and waste

ZDHC reference

▶ ZDHC CMS 3.6 Emergency Procedures; deliverable: Emergency Response Plan

6.8 PLAN AND PREPARE FOR CHEMICAL EMERGENCIES

Management has a responsibility to establish procedures to deal with emergencies and accidents that might arise from the use of hazardous chemicals at work. These procedures must be reviewed regularly and changed as appropriate when, for example:

- new chemicals are brought into the work-place
- new chemical processes are developed or existing processes are changed

To preparate for chemical emergencies, look into the requirements for the (1) prevention of and (2) response to emergency situations. This process involves an assessment of where, what chemical emergencies with which probability may happen.

Practical tips

As part of your emergency planning process, consider the use of or consult your eco-maps in order to identify and document areas and types of possible chemical emergencies in your company.

6.8 PLAN AND PREPARE FOR CHEMICAL EMERGENCIES

DEAL WITH CHEMICAL FIRES AND EXPLOSIONS

The risk of a fire is based on the presence and combination of three basic factors:

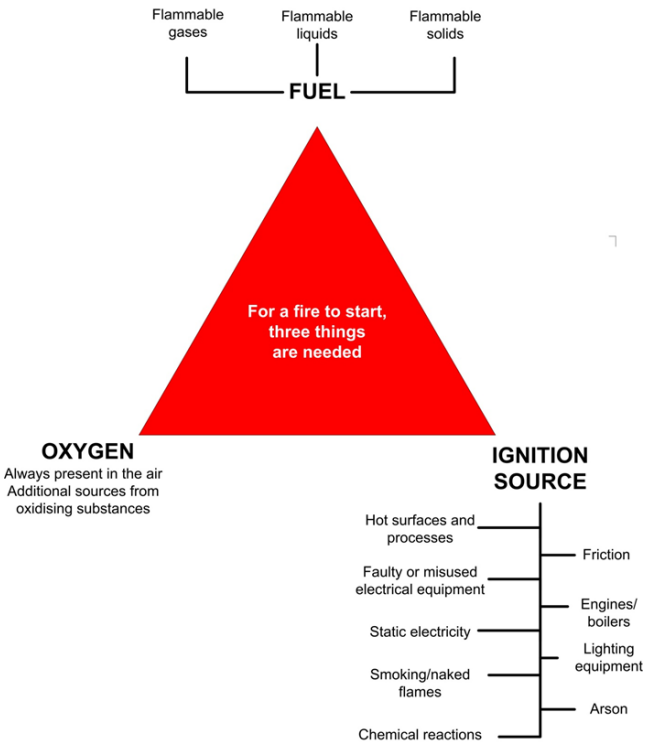
(1) the availability of fuel (differentiated by the degree of flammability of a substance)

(2) the availability of source of ignition/heat and

(3) the ambient conditions such as the temperature and presence of oxygen.

The control of at least one of these three factors will significantly reduce the probability of a fire, for example:

- Substitution of highly flammable substances with non-flammable ones, segregation of incompatible chemicals, segregation of flammable materials and potential sources of ignition (e.g. no smoking rule in chemical store, placement of electrical switches outside the store)



6.8 PLAN AND PREPARE FOR CHEMICAL EMERGENCIES

CLASSES OF FIRE AND HOW TO PREVENT THEM

Class A	Class B	Class C	Class D
Ordinary combustibles (wood, paper, trash, cloth)	Flammable and combustible gases and liquids	Energized electrical equiment	Combustible metals (e.g. Magesium, titanum, potassium, sodium
Routine housekeeping and cleaning	Good handling and storage practices	Good maintenance and prevention of misuse	Follow special advice
Make sure storage and working areas kept free of trash	Reduce ventilation to prevent build-up flammable vapor or gas concentrations Storage of substances in tighty sealed containers Storage away from spark-producing sources Limit portable storage containers to 20 liters each Avoid storage of more than 100 liters of flammable liquids inside a building unless in approved storage containers	Regularly check electrical equipment for old/worn wiring or broken/damaged fit-tings. Report any hazardous conditions to your supervisor Prevent electric motors from overheating by keeping them clean and in good working order Never install a fuse rated higher than specified for a circuit Never overload wall sockets. One outlet should have no more than two plugs Don’t plug more than one heat-producing appliance into an outlet Investigate any appliance or equipment that smells strange. This is often the first sign of a fire Use utility lights that have some type of wire guard over them. Direct contact with an uncovered light bulb can ignite combustible material	

6.8 PLAN AND PREPARE FOR CHEMICAL EMERGENCIES

DEAL WITH CHEMICAL FIRES AND EXPLOSIONS

Prevent and responding to different types of fire

By applying the following principles you will be well on the way to making sure that you are working safely with flammable substances:

(1) Ventilation - Is there plenty of fresh air where flammable liquids or gases are stored and used? Good ventilation will mean that any vapors given off from a spill, leak or release from any process, will be rapidly dispersed.

(2) Ignition - Have all the obvious ignition sources removed from the storage and handling areas. Ignition sources can be very varied and they include sparks from electrical equipment or welding and cutting tools, hot surfaces, open flames from heating equipment, smoking materials, static electricity etc.

Understanding some basic terminologies

Auto ignition temperature means the minimum temperature required to cause self-sustained combustion, independent of any other source of heat.

Boiling point means the temperature at which a liquid boils at a fixed pressure, especially under standard atmospheric conditions (liquid and vapor phases are in equilibrium with each other at a specified pressure).

Flashpoint means the lowest temperature at which a liquid gives off enough vapor to form an ignitable mixture with air and burn when a source of ignition (sparks, open flames, cigarettes, etc.) is present.

Lower flammable limit (LFL) means the lowest concentration of a material that will propagate a flame. The LFL is usually ex-pressed as a percent by volume of the material in air (or other oxidant).

Explosive atmosphere is an accumulation of gas, mist, dust or vapor, mixed with air, which has the potential to catch fire or explode. An explosive atmosphere does not always result in an explosion, but if an explosive atmosphere exists, there is a real danger of an explosion.

6.8 PLAN AND PREPARE FOR CHEMICAL EMERGENCIES

DEAL WITH CHEMICAL FIRES AND EXPLOSIONS

Prevent and responding to different types of fire

(3) Hazardous areas (zoning): - The extent of safety measures required to avoid ignition sources depends on the area in which the operation takes place. As far as the likely presence of ignitable gas/air or vapor/air mixtures is concerned, the following zones can be defined:

- ***Zone 0***: Areas in which an explosive atmosphere is continually present or present for long periods of time.
- ***Zone 1***: Areas in which an explosive atmosphere is likely to occur during normal operation. These conditions can prevail in the immediate vicinity of Zone 0.
- ***Zone 2***: Areas in which an explosive atmosphere is unlikely to occur during normal operation and, if it occurs, will only exist for a short time. These conditions can, among others, pre-vail in areas surrounding Zones 0 and 1.

Using hazard zoning

According to the classified zones part or all of the electrical equipment used may have to be flame or explosion-proof standard.

Sound electrical safety is to be maintained (i.e. adequate earthing, overload protection, equipment and wiring in good repair).

Hot surfaces and mechanically generated sparks should be avoided in such hazardous areas. Auxiliary equipment such as petrol or gas-driven fork-lift trucks, electrical dryers, shrink wrapping equipment with open ignition sources and battery charging stations must not be used in hazardous areas defined as zone 0 to 2.

Non-routine activities such as maintenance work and plant clean-outs, which can produce ignition sources (e.g. welding, drilling, etc.), must be authorized be means of written work permits

6.8 PLAN AND PREPARE FOR CHEMICAL EMERGENCIES

CHEMICAL FIRES AND EXPLOSIONS

Prevent and responding to different types of fire

(4) Exchange (Substitution) - Can you exchange a flammable substance for a less flammable one? Can you eliminate flammable substances from the process altogether? You may be able to think of other ways of carrying out the job more safely.

(5) Containment - Are your flammable substances kept in suitable containers? If you have a spill will it be contained and prevented from spreading to other parts of the working area? Use of lidded containers and spillage catchment trays, for example, can help to prevent spillages spreading. Keep absorbent material handy.

(6) Segregation - Are flammable substances stored and used well away from other processes and general storage areas? Can they be segregated by a physical barrier, wall or partition?

Think about the flammable substances you have at the workplace and apply these principles wherever possible.

Tell workers and others who need to know, about the hazards and how they should control them.

Implement **passive fire protection measures**, such selecting locations as well as preparing structures, e.g. evacuation routes, provision of evacuation plans, fire resistance materials and doors. Check with the regulatory requirements in your location.

6.8 PLAN AND PREPARE FOR CHEMICAL EMERGENCIES

DEAL WITH CHEMICAL FIRES AND EXPLOSIONS

Select fire fighting measures

Each fire extinguisher displays a rating on the faceplate showing the class of fire (see above) it is designed to put out. Some extinguishers are marked with multiple ratings such as AB, BC or ABC.

Extinguisher	Description
Class A	Class A extinguishers are effective on ordinary combustibles. The extinguisher cools the temperature of the burning material below its ignition temperature. The extinguishers use pressurized water, foam or multi-purpose dry-chemical agents. Class A extinguishers carry a numerical rating that indicates how large a fire you can safely put out with that extinguisher.
Class B	Class B extinguishers should be used on flammable liquids or gases. Class B extinguishers may come in several types including foam, carbon dioxide, ordinary dry-chemical, multi-purpose dry-chemical or halon replacements.
Class C	Class C extinguishers are to be used specifically on electrical fires. Class C extinguishers may contain carbon dioxide, ordinary dry-chemical, multi-purpose dry-chemical or halon replacements. Carbon dioxide or halon replacements, which do not leave a harmful residue, are preferable for computers and other sensitive equipment. Never use water extinguishers or any extinguishing agent capable of conducting electricity on Class C fires. Class C extinguishers carry a letter rating only to indicate that the extinguishing agent will not conduct electricity.
Class D	Class D extinguishers should only be used on combustible metals. Class D extinguishers are made with agents specially designed for the material involved. In most cases, they absorb heat and cool the material below its ignition temperature. Class D fires react violently to water and other types of chemicals. Class D extinguishers carry only a letter rating to indicate their effectiveness on certain amounts of specific metals.

6.8 PLAN AND PREPARE FOR CHEMICAL EMERGENCIES

DEAL WITH CHEMICAL FIRES AND EXPLOSIONS

Select fire fighting measures

Practical tips

Display fire extinguisher charts for further guidances

Fire Extinguisher Chart

Extinguisher		Type of Fire				
Colour	Type	Solids (wood, paper, cloth, etc)	Flammable Liquids	Flammable Gasses	Electrical Equipment	Cooking Oils & Fats
	Water	✓ Yes	✗ No	✗ No	✗ No	✗ No
	Foam	✓ Yes	✓ Yes	✗ No	✗ No	✓ Yes
	Dry Powder	✓ Yes	✓ Yes	✓ Yes	✓ Yes	✗ No
	Carbon Dioxide (CO2)	✗ No	✓ Yes	✗ No	✓ Yes	✓ Yes

Remember

Only use a fire extinguisher when it is safe to do so. If the fire is too big, if it is spreading or threatening to block your path to escape leave the area immediately.

If necessary, do not hesitate to use the extinguisher to clear an escape path.

As part of your planning , also assess how long it would take for external fire fighting services to reach your location.

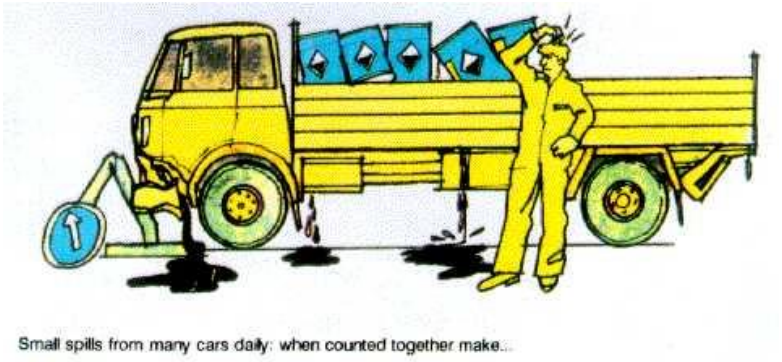
6.8 PLAN AND PREPARE FOR CHEMICAL EMERGENCIES

CONTROL SPILLS AND LEAKS

Even in the best run chemicals stores and areas, where chemicals are repacked, transferred into other containers or mixed, there will occasionally be spills. Such spills must be cleaned up immediately as part of your housekeeping.

Leakage from containers is a major problem in the storage and transport of chemicals.

Dusts, wetable powders or granules can create dust when swept up without the use of an absorbent material. A supply of absorbent sawdust, sand or dry soil should be kept in a container in the store where they can easily be reached for use in an emergency



Small spills from many cars daily: when counted together make...

Source: ILO-CIS

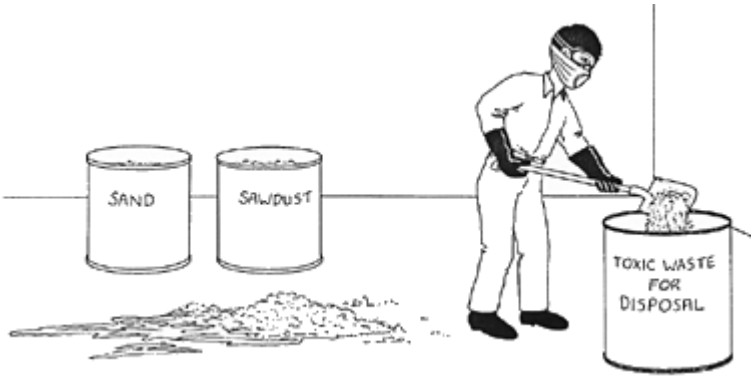
6.8 PLAN AND PREPARE FOR CHEMICAL EMERGENCIES

CONTROL SPILLS AND LEAKS

Preparation and response

- Ensure availability of procedures for reporting and response to (minor and major) chemical spills and leaks, including assignment of roles and responsibilities
- Provide training
- Have spill control pillows or neutralizing agents available in case of a spill. These may be purchased from safety supply companies
- Provide and use of personal protective equipment during clean-up.
- Keep separate receptacles available to allow for safe disposal of the leaked and absorbent material.

- ▶ Alert and report
- ▶ Evacuate possibly affected persons
- ▶ Contain spill and leak to prevent spread of the material to other areas
- ▶ Stabilize / dilute spilled materials to safe condition
- ▶ Clean up



Source: FAO, Pesticide Storage and Stock Control Manual

6.8 PLAN AND PREPARE FOR CHEMICAL EMERGENCIES

PROVIDE EMERGENCY TRAINING

As part of the preparations, the management will establish and implement in-house training program to deal with chemical emergencies. An emergency training program may include the following:

- arrangements for raising the alarm
- calling on the appropriate emergency assistance
- use of appropriate personal protective equipment (and its limitations) while dealing with the emergencies
- actions to evacuate anyone in immediate danger
- the provision of life-saving first aid
- the use of specialized equipment and materials including first-aid, fire-fighting, and spill and leak control equipment;
- actions to minimize the magnitude of the incident
- actions to evacuate adjacent premises when necessary

Guiding questions

☐ Has your company established procedures to deal with emergencies and accidents that might arise from the use of hazardous chemicals at work?

☐ Has your company established a training program for workers to deal with emergencies, specifically including chemical emergencies?

☐ Can the worker(s) out-line the measures they have to take to deal with first-aid, fire or spill and leak situations involving chemicals?

USEFUL LINKS FOR COMPLETING STEP 6, TASK 6.8

For further information and use *Some useful links*		
	Emergency plan	Sample outline of an emergency plan
	Fire risk assessment	Assess fire risk using control banding approach
	Using flammable liquids	Safe use and handling of flammable liquids, Guideline by HSE, UK, HSG140

Click on the green document icons to get further information

6.9 MANAGE AND DISPOSE CHEMICAL WASTE

The objective of proper hazardous waste management is to prevent harm to the environment and human health arising from such waste as part of the overall chemicals management in your company. While this is relevant for all the people working in your company, this applies even more to the staff involved in handling hazardous waste on-site before it is handed over to a hazardous waste transporter.

Based on the waste inventory (see section 3.3) your company now needs to decide how to management the different types of wastes generated. The various control measures will result in a change of the waste composition and characteristics.

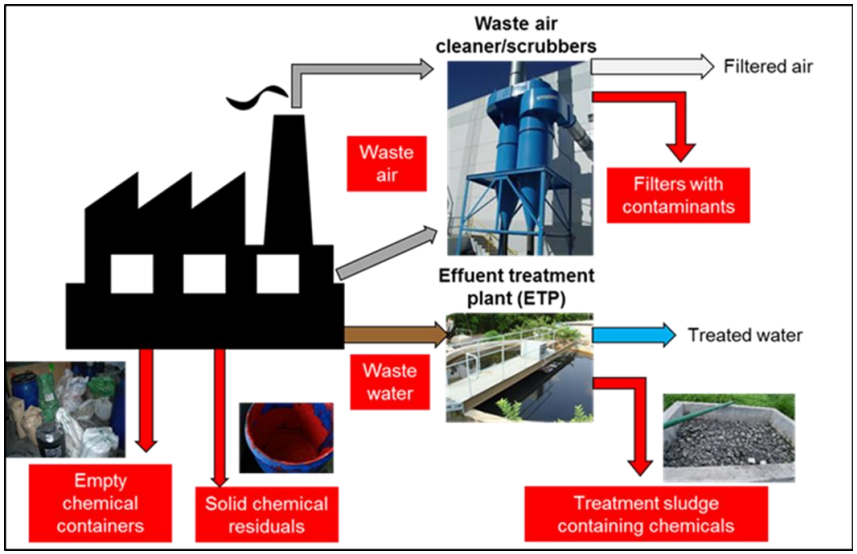
Possible sources of chemical waste in your company
• Off-specification, unwanted or spilt raw material (e.g. raw material which has exceeded “shelf life”, chemicals spilt in storage etc.)
• Raw materials or items which are used in a process but not consumed by that process (e.g. oil filters, dust filters, used oil, expired batteries etc.)
• Materials resulting from process start-ups (e.g. solvent washings of reaction vessels/pipe work)
• Unwanted by-products from a process (e.g. contaminated rinse waters/solvents, etc.)
• Results of process malfunctions / poor control (e.g. off-specification batch of product, partially reacted materials, etc.)
• Material resulting from process shut down (e.g. residues from reaction vessels / pipe work, washings from vessels/pipe work, printing screens)
• Materials resulting from routine in-situ maintenance of the process equipment (defective components, used oil, filters, cleaning materials, solvents etc.)
• Sludges from waste water treatment plants and air emissions control residues

6.9 MANAGE AND DISPOSE CHEMICAL WASTE

WASTE AND WASTE WATER MANAGEMENT

Concepts and ideas

- Treat waste water within the company or externally (effluent treatment plant, common effluent treatment plant)
- Channel highly-polluted and mildly-polluted waste water flows separately in order to achieve improved cleaning efficiency.
- Collect unavoidable solid waste separately
- Prevent the pollution of waste with hazardous waste via strict separation of waste.
- Use returnable chemical containers
- Exhaust air treatment for emissions-relevant processes.



6.9 MANAGE AND DISPOSE CHEMICAL WASTE

WASTE MANAGEMENT IN TEXTILE SECTOR

In textile finishing industries, many different solid and liquid wastes are generated and have to be disposed of. Some of them can be recycled or re-used, whereas others are incinerated or landfilled. There are also some wastes which (in a few cases) are treated in anaerobic digesters.

Waste in need of	General waste	Textile industry specific waste
No control	Waste glass, paper, paper board, wood, iron scrap (pipes, old machines), electric cables, plastic drums (clean), metal drums (clean), non-contaminated plastic wrap	Waste yarn, waste fabric (spoilt works, trials, selvedge cuttings), wastes from shearing and raising, textile dust
General control	Waste oil, oil-contaminated cloths, non-halogenated organic solvents, soot from oil incinerators, glue and adhesive agents, contaminated packages	Dyes and pigments, residual padding dyeing liquors, residual printing pastes, residual padding finishing liquors, oil-containing condensates from off-gas treatment (stenters), sludge from process waste water treatment
High control	Waste from oil/water separators, halogenated organic solvents, PCB-containing condensers	

Source: BREF/BAT Textile 2003

6.9 MANAGE AND DISPOSE CHEMICAL WASTE

SELECT AND PLAN WASTE MANAGEMENT MEASURES

Once you have updated your waste inventory, can plan the next steps how to manage and finally dispose the waste of your company. Your action plan for addressing the management of chemical waste in your company will follow the same principles as the one you have prepared for your control measures detailing:

- What measures to take for improving the situation in the company
- Who is/are the person(s) in charge?
- By when to be competed?
- What resources required (Data, funds, person)?

Guiding questions - Waste management

☐ Do you systematically identify and quantify all chemical wastes (NPOs) in your company and make their costs visible?

☐ Do you identify, separate and classify the hazardous wastes?

☐ Do you maintain a waste inventory table?

☐ Do select and plan for waste management measures to:

- correctly separate waste at generation point
- have an internal report on wastes
- arrange for safe on-site collection, labeling and storage of wastes
- carry out preliminary treatment on-site
- arrange for further off-site treatment and disposal?

6.9 MANAGE AND DISPOSE CHEMICAL WASTE

ASSIGN CLEAR RESPONSIBILITIES

The overall responsibility to use chemicals safely rests with the owner and/or management of your company. The same applies to the management and disposal of the hazardous chemical waste.

Depending on where your company is located, there might be some specific legal requirements regarding the assignment of employees dedicated to the management of hazardous wastes. Even if such requirements do not exist in your country, it is helpful to assign the operational responsibility of hazardous waste management to a suitable person or team.

Example from Germany: Waste Management Officer

In Germany, in order to obtain a valid operating permission for a company generating hazardous waste, one of the pre-requisites is that a person responsible for internal hazardous waste management is nominated. The law further requires that any establishment generating hazardous waste must nominate its own officer: a waste manager officer (WMO). This person is often simultaneously responsible for pollution prevention and occupational safety and health. The WMO must be reliable, qualified and competent. This may be proven through training record / evidence of education in the field of “maintenance and disposal”, or through documentation of long-term practical experience.

6.9 MANAGE AND DISPOSE CHEMICAL WASTE

TRAIN AND QUALIFY PERSONNEL INVOLVED IN HANDLING HAZARDOUS WASTE

Personnel involved in the handling or management of hazardous waste must be trained to ensure that they are able to respond effectively to emergency situations. All facility personnel working on production lines and processes generating hazardous wastes should be provided with initial training and annual refresher training covering the following aspects:

- ☐ presence of the specific materials
- ☐ potential physical and health hazards associated with these waste materials
- ☐ proper procedures for handling and use of these materials, including the use of personal protective equipment (i.e. gloves and protective goggles)
- ☐ location and appropriate use of the chemical Safety Data Sheets
- ☐ procedures to be followed in the event of an emergency situation

Guiding questions

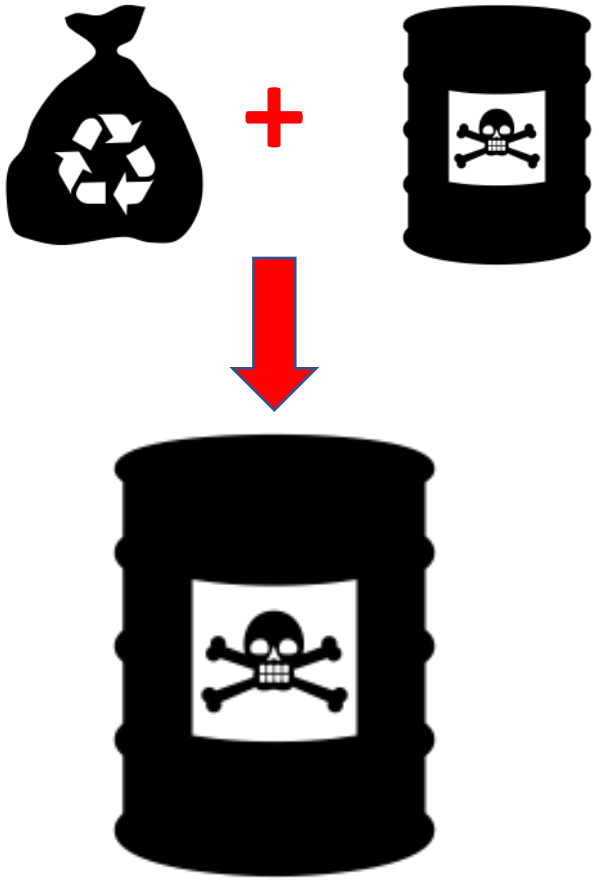
- ☐ Do you systematically identify and quantify all chemical wastes (NPOs) in your company and make their costs visible?
- ☐ Do you identify, separate and classify the hazardous wastes?
- ☐ Do you maintain a waste inventory table?
- ☐ Do select and plan for waste management measures to:
  - correctly separate waste at generation point
  - have an internal report on wastes
  - arrange for safe on-site collection, labeling and storage of wastes
  - carry out preliminary treatment on-site
  - arrange for further off-site treatment and disposal?

6.9 MANAGE AND DISPOSE CHEMICAL WASTE

SEPARATE HAZARDOUS FROM NON-HAZARDOUS WASTE AS SOON AS POSSIBLE

The separation and interim storage of hazardous and non-hazardous waste is the first important aspect in waste management. Hazardous waste is usually costlier to treat and dispose of.

When hazardous and non-hazardous wastes get mixed all of the resulting waste may have to be considered as hazardous waste, resulting in an increase of your treatment and disposal costs



6.9 MANAGE AND DISPOSE CHEMICAL WASTE

SEGREGATE COMPATIBLE FROM NON-COMPATIBLE WASTES DURING STORAGE AND HANDLING

Hazardous wastes of different nature and composition must not be mixed either. As in the case of incompatible chemicals, different types of in-compatible chemical wastes can react with each other as well and generate equally or more hazardous reaction products, or result in an explosion. Also segregate liquid hazardous waste from solid hazardous waste.

To check the compatibilities of the different types of waste, refer to the table in section 6.6 safe storage of chemicals.

The different types of waste must be put into appropriate containers made of material compatible with the content – e.g. plastic containers for acids and bases, metal drums or other metal containers for organic solvents. You have to train your personnel in the appropriate use of the different containers for hazardous wastes.

6.9 MANAGE AND DISPOSE CHEMICAL WASTE

ORGANIZE SAFE ON-SITE STORAGE OF HAZARDOUS WASTE

Depending on the situation in your location, it may not be possible to dispose of hazardous waste off-site immediately. Often the hazardous waste may need to be stored on-site until it can be transported to a location for its final treatment and disposal.

The on-site interim storage must be organized in such a manner that

- subsequent off-site treatment will not be hampered and
- no danger for staff or the environment will arise from the waste during its interim storage on-site.

Practical tips

The different types of hazardous wastes should be already identified and separated at their place/source of generation. Make sure that you

- inform, train and instruct your staff on how to identify, separate and store the hazardous waste
- provide for appropriate containers in sufficient numbers to collect the waste at the place of generation and transport to an interim on-site storage area
- respect the incompatibilities of wastes during the entire period of storage.

6.9 MANAGE AND DISPOSE CHEMICAL WASTE

ORGANIZE SAFE ON-SITE STORAGE OF HAZARDOUS WASTE

Make sure to only select and use containers that are made of, or lined with, material that is compatible with the hazardous waste to be stored in them. Using clearly marked containers - maybe even of different colors facilitates the separation of different types of waste at the point of generation.

Source: GIZ PSES

6.9 MANAGE AND DISPOSE CHEMICAL WASTE

ORGANIZE SAFE ON-SITE STORAGE OF HAZARDOUS WASTE

In small and medium-sized enterprises, hazardous wastes are often generated only in small quantities. Therefore, on-site collection and interim storage is necessary until quantities large enough for shipment by a licensed hazardous waste transporter are accumulated.

Designate one suitable area in your company for on-site storage of hazardous waste.

Check your waste storage area:

- ☐ Is the area needs big enough to hold the quantities of hazardous waste generated between the usual pick-up dates or further scheduled times of disposal for the hazardous waste?
- ☐ Are different (incompatible) types of hazardous waste stored separately?
- ☐ Is the area protected from sun and rain? Excessive heat might trigger a fire or explosion, while rain water might mix with residue of leaked chemical wastes and effuse/flow out, contaminating soil and groundwater
- ☐ Does the storage area have provisions to contain any leakage or spillage? The floor needs to be made of impermeable material or plastic sheets or lined with sheets as well as having provisions for containment / dyking.

6.9 MANAGE AND DISPOSE CHEMICAL WASTE

ORGANIZE SAFE ON-SITE STORAGE OF HAZARDOUS WASTE

Once you have identified and prepared the storage area, also ensure that the area is clearly marked and access is/can be limited to authorized personnel only. Display warning signs describing precautionary and preventive measures.

In the case of intermediate storage of flammable and explosive waste, the safety precautions to be observed are the same as for the storage and handling of chemicals – i.e. installation of explosion-proof electric and electronic equipment and fire-extinguishing features in the area of intermediate storage. Further emergency provisions should be available for the hazardous waste storage area for containing leakages and spillages (e.g. spill absorbing material and special additional waste containers).

Source: GIZ PSES

6.9 MANAGE AND DISPOSE CHEMICAL WASTE

ENSURE GOOD WASTE HANDLING PRACTICES

An excellent method of informing your staff is to draw up a plant-specific waste guide that lists any waste generated in the plant and indicates how to proceed with and handle it.

Recommended good handling practices

☑	Keep storage area clean
☑	Maintain the containers in good condition and immediately replace leaking ones
☑	Keep the hazardous waste containers closed at all times except when removing wastes
☑	Never fill to the line any container containing liquid hazardous waste, and allow at least 5 cm of air space near the top to control vapor pressure inside
☑	Follow working procedures and instructions regarding the safe handling and emergency response
☑	Use the designated personal protective equipment

6.9 MANAGE AND DISPOSE CHEMICAL WASTE

SELECT A COMPETENT WASTE SERVICE PROVIDER

In case you avail the services of an external waste service provider, it will be your responsibilities to ascertain the quality and competence of such service providers. Depending on the regulatory framework, this, include at least the verification whether the service providers has the necessary permits and licenses and/or obtaining a declaration from the service provider that the waste is treated or disposed according to national or international regulations.

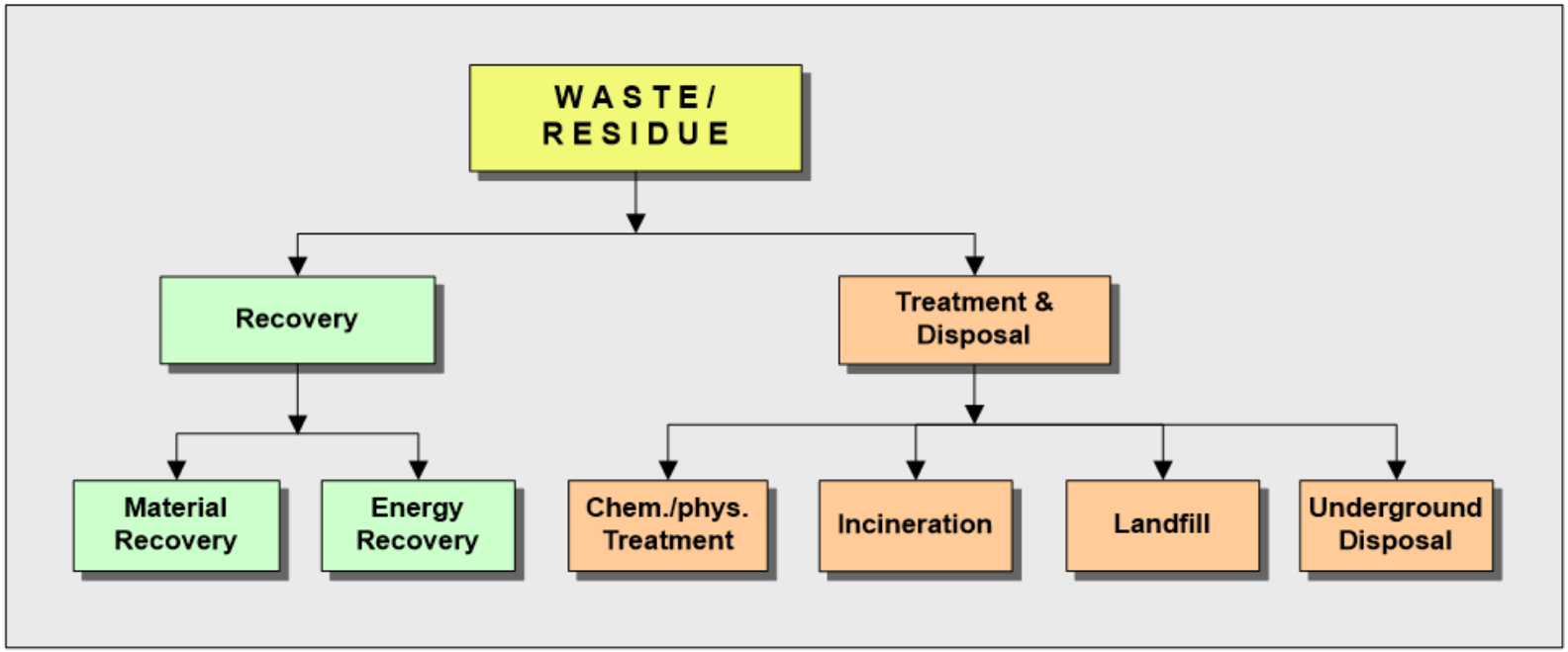
Scope of services to be expected from your waste service provider

- General advice on waste/hazardous waste management
- Help with classification and labeling
- Guidance on packing and recommendations for containers and volumes
- Rent, delivery and collection of containers
- Safe transport of containers to treatment facilities
- Preparations for safe transport and labeling
- Special advice in the form of an external consultant acting as an outsourced waste manager officer for the company

6.9 MANAGE AND DISPOSE CHEMICAL WASTE

LOOK INTO OFF-SITE WASTE MANAGEMENT OPTIONS

Off-site waste management deals with the further treatment and final disposal of the waste removed from your company. In many countries you still have a responsibility towards your waste even when it has left your company. Therefore, it is important to select the right option of final management or disposal of your waste.



Source: UNIDO

6.9 MANAGE AND DISPOSE CHEMICAL WASTE

LOOK INTO OFF-SITE WASTE MANAGEMENT OPTIONS

These treatment and disposal operation have to be carried out in an environmentally sound way to meet all regulations, etc. As the off-site treatment and disposal of waste, particularly of hazardous waste, can be rather expensive, avoiding waste and, if this is not possible, then reducing these wastes are preferable options. The latter also includes the minimization of hazardous waste as such.

The on- or off-site treatment options also include the recovery and reuse of valuable materials contained in the waste, which can be reprocessed as secondary raw material (circular economy), either by your company or off-site by another company.

Co-processing in cement plants

Energy to waste conversion

Controlled landfilling

6.9 MANAGE AND DISPOSE CHEMICAL WASTE

TREAT YOUR WASTE WATER

Both the textile and leather manufacturing processes require large amounts of water. Not all of the chemicals added to the float end up in the final product, but get discharged with the used process water. Depending on the type and concentration of the chemicals in the waste water, these chemicals, if not treated, contaminate surface and ground water, affect the aquatic life, and pose health hazards to those who use the water from such water bodies.

Take a quick look

☐ Does your company have an in-house effluent treatment plant (ETP) or is connected to an external one e.g. common effluent treatment plant (CETP)?

☐ Does your company have a valid environmental license to operate?

☐ Does the ETP/CETP comply consistently with wastewater discharge permits at all times?

☐ Is you ETP operated by qualified personnel?

- ZDHC has compiled guideline covering expectations on waste water and sludge for the entire textile and footwear industry. www.roadmaptozero.com/fileadmin/content_2016/Files_2016/ZDHC_Wastewater_Guidelines.pdf

6.9 MANAGE AND DISPOSE CHEMICAL WASTE

TREAT YOUR WASTE WATER

Waste water quantity benchmarks in textile industry	L/kg
Wool scouring	2 - 6
Yarn finishing (wool)	35 - 45
Yarn finishing (cotton)	100 - 120
Yarn finishing (synthetic fibres)	65 - 85
Finishing of knitted fabrics (wool)	60 - 70
Finishing of knitted fabrics (cotton)	60 - 136
Finishing of knitted fabrics (synthetic fibres)	35 - 80
Finishing of woven fabric (wool)	70 - 140
Finishing of woven fabric (cotton)	50 - 70
Finishing of woven fabric (synthetic fibres)	100 – 180

Source: BREF BAT/Textile, 2003

Waste water quantity benchmarks in leather industry	L/kg
Bovine leather (from raw to finished)	12 -30
Pig skin leather (from raw to finished	32 - 69
Sheep/goat skin leather (from raw to finished)	110 – 265 per skin
Wool-on sheep skin leather (from raw to finished)	360 per fell

Source: BREF BAT/Leather, 2013

6.9 MANAGE AND DISPOSE CHEMICAL WASTE

TREAT YOUR WASTE WATER

As per ZDHC your company is expected to follow generally-accepted process engineering best practices with respect to wastewater treatment and overall facility water efficiency management.

In addition to the treatment of all your waste water and discharge as per established discharge limits/standards, special attention needs to be paid to the management of the treatment sludge. Textile waste water treatment generates about 1- 5 kg per m3 of waste water, leather tanning about 5 – 8 kg per m3 of waste water)

Depending on the concentration of certain chemicals in the sludge the same be considered as hazardous waste, requiring the further removal and disposal of the sludge by licensed/permitted and qualified third parties that have appropriate facilities to properly dispose of the sludge wastes to ensure that sludge and leachates from the sludge do not adversely impact the environment.

Source: GIZ PSES

Substitution of hazardous chemicals and application of BATs will help you to reduced the hazard levels of your treatment sludge and waste, reducing the cost for their treatment and disposal.

6.9 MANAGE AND DISPOSE CHEMICAL WASTE

RECOVER AND REUSE CHEMICALS

A segregation of waste water streams allows for the consideration of various direct recycling and recovering technologies for certain process chemicals. The application of such technologies will reduce your cost of chemicals while lowering the capital investment and operating costs for the effluent treatment.

Example of recycling and recovering technologies

Textile	Leather tanning
Recovery of alkalis from mercerizing	Recycling of lime liquor
Printing paste recovery from the supply system	Chrome recovery
Recovery of sizing agents by ultralfitration	

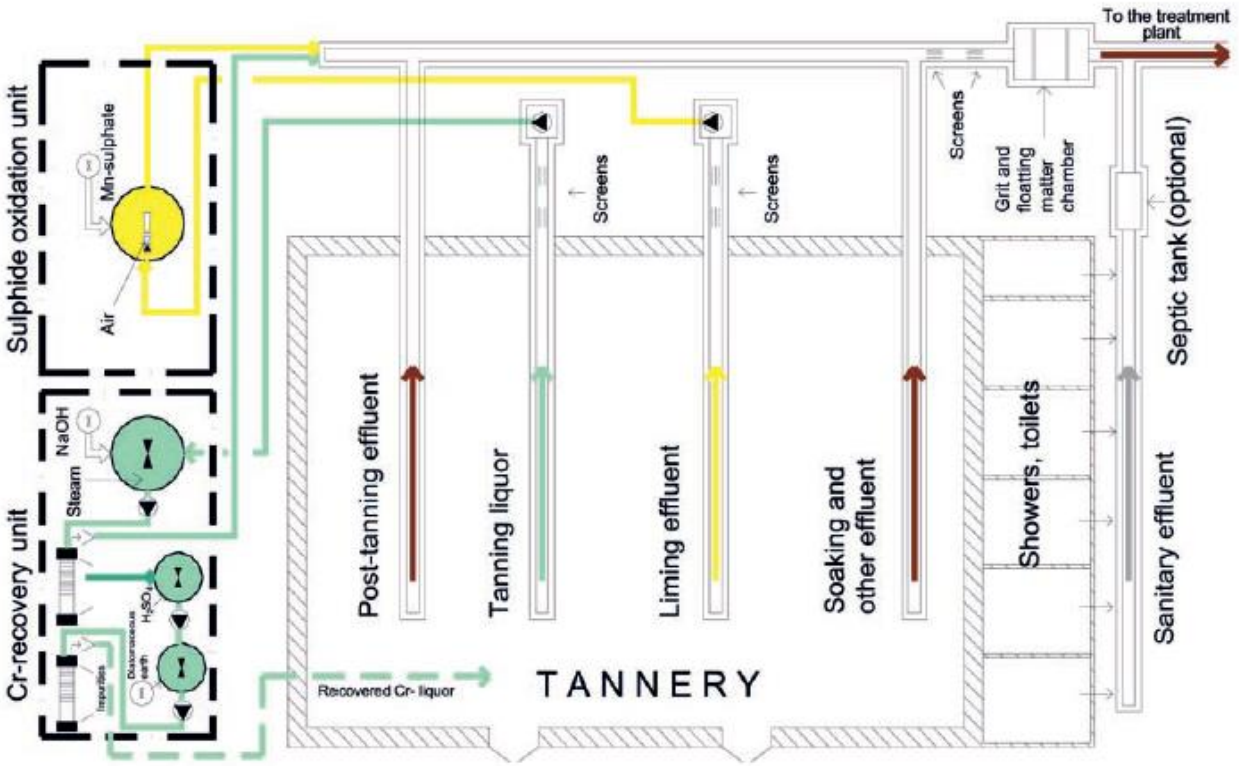
Chrome recovery system in a tannery, Source: UNIDO Leather Panel

For further information on sector specific reccling and recovery technologies, refer to the European BREF/BATs http://eippcb.jrc.ec.europa.eu/reference/

6.9 MANAGE AND DISPOSE CHEMICAL WASTE

RECOVER AND REUSE CHEMICALS

Example of waste stream segregation and treatment and recovery



Segregating chrome contain and sulphide containing waste liquors for separate recovery and recycling and oxidation in leather production; Source: UNIDO

6.9 MANAGE AND DISPOSE CHEMICAL WASTE

MOVE TOWARDS ZERO-LIQUID DISCHARGE (ZLD)

The application of alternative process technologies (low-float, water-less/free) the water footprint can be significantly reduced.

Dwindling water resources, drop in ground water tables and emerging conflicts about use of remaining water sources requires the need to explore further steps, such as towards partially or fully closed water systems. Treated waste water is recovered and can be reused in process.

In several countries, textile and leather industry is already required to install zero-liquid discharge systems. A full recovery of waste water entails a full treatment and/or recovery of chemicals in the effluent. Such ZLD systems usually consist of multi-stage filtration and evaporation components.

ZLD systems in textile and leather sector units in Southern India, photo credits: Dr K V Emmanuel

6.9 MANAGE AND DISPOSE CHEMICAL WASTE

CONTROL YOUR AIR EMISSIONS

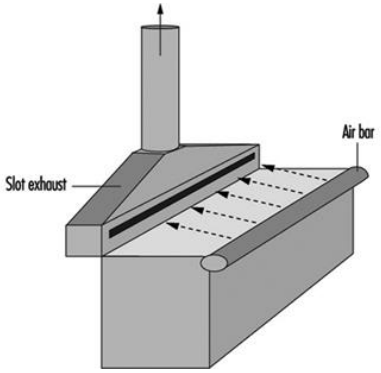
Typical source of air emissions in textile and leather sector

Type	Sources in textiles industry	Process sources in leather industry
Dust	Fiber (especially cotton) handling and storage	Storage and handling of powdery chemicals, dry shaving, buffing, dust removal machines, milling drums, and staking operations.
Air pollutants	Regenerated fibers (viscose) and synthetic polymers (nylon and acrylic fibers) production processes (of chemicals (e.g. release of carbon disulfide, hydrogen sulfide, hexamethylene diamine, and nitric acid).	Ammonia from deliming operations Hydrogen sulfide (discharge of liming and deliming liquors, cleaning operations / sludge removal in gullies and pits, and bulk deliveries of acid or chrome liquors pumped into containers with solutions of sodium sulfide).
Volatile organic compounds (VOC) and oil mists	Organic solvents in activities such as printing processes, fabric cleaning, wool scouring and heat treatments Exhaust air from stenter frames and printing processes	Degreasing and finishing processes in tanneries Closing and finishing operations in footwear manufacture
Exhaust gases	Combustion sources for power generation (generator sets) and process heating (fired boilers), transport vehicles	
Odors	Dyeing and other finishing processes (e.g. oils, solvent vapors, formaldehyde, sulfur compounds, and ammonia.	Putrefaction of raw hides/skins and their waste (cuttings, trimmings, fleshings), hydrogen sulfide from beamhouse and treatment plant operations

6.9 MANAGE AND DISPOSE CHEMICAL WASTE

CONTROL AIR EMISSIONS – LOCAL EXHAUST VENTILATION (LEV)

- Connect local exhaust ventilation (LEV) at the source of the emission. There should be a sufficient airflow to capture the dust or vapor before it disperses in the work-place. For dust, airflows greater than 1 m/s will generally be needed and for vapors, airflows greater than 0.5 m/s. The airflow should be measured at the origin of the dust or vapor with an anemometer. Provide an easy way of checking that the LEV is working such as a ribbon strip attached to the output side.
- Contain the source of dust or vapor as much as possible to stop it from spreading. Keep the hood as close as possible to the source of exposure
- Don't allow the workers to get in between the source of exposure and the LEV; otherwise they will be in the path of the contaminated air.
- Where possible, locate the work away from doors and windows to stop draughts from interfering with the LEV and spreading dust or vapors.
- Keep extraction ducts short and simple and avoid long sections of flexible duct.
- Discharge extracted air in a safe place away from doors, windows and air inlets. Be careful that extracted air does not affect your neighbors.



Source: ILO

6.9 MANAGE AND DISPOSE CHEMICAL WASTE

CONTROL AIR EMISSIONS

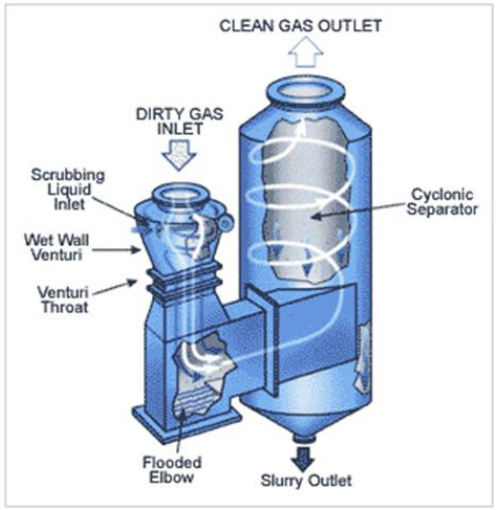
The trapped contaminants are conveyed by ducts to a collector (cyclone, filter house, scrubbers or electrostatic precipitators) where they are removed before the air is discharged into the outside environment.

This is accomplished by a special exhaust system or by increasing the general ventilation

For consideration:

Substitution of hazardous chemicals and process changes (see BATs) significantly reduce the need of such end-of-pipe treatment facilities.

Source: GIZ CHS



Source: Bintex Enviro-systems, India

Source: GIZ CHS

USEFUL LINKS FOR COMPLETING STEP 6, TASK 6.9

For further information and use *Some useful links*		
	Local exhaust ventilation	Controlling airborne contaminants at work - A guide to local exhaust ventilation (LEV), HSE, UK
	Hazardous waste management concepts	Link to the GIZ toolkit on waste management
	Waste management checklist	Checklist to assess waste management practices in your company

Click on the green document icons to get further information

STEP 7

MONITORING, REVIEWING AND REPORTING PERFORMANCE

This part of the tookit looks into various aspects of assessing and reporting the progress. Monitoring, measuring, reporting and auditing are important components of any system, as they provide the required feedback, whether you are on track and what else needs to be done.

Tasks/Elements

7.1 Audit your CMS (internal, external)

7.2 Conduct Management review

7.3 Report chemical management performance reporting

ZDHC CMS References

ZDHC CMS 4.2 Internal Audit

ZDHC CMS 4.3 External Audit

ZDHC CMS 5.2 Stakeholder Review

ZDHC CMS 5.3 Management Review

7.1 AUDIT YOUR CMS (INTERNAL, EXTERNAL)

Periodic assessments of your company`s chemical management performance (e.g. internal and external audits) will provide you with an overall picture of the performance and will support with your efforts in continual improvement. The internal audit will help you to ensure the proper implementation and maintenance of the CMS by verifying that activities conform with documented procedures and that corrective actions are undertaken and are effective. The audit my also focus on compliance with regulatory or customer requirements.

The result and findings of these assessments form the basis for the annual management review as well as for communicating the achievements to your stakeholders.

It is recommended that all CMS audits are conducted by trained auditors at least once a year. Ideally, have at least two trained internal auditors in your company or engage external experts as your auditors.

- As per the ZDHC CMS, your company is expected to establish, document and implement a process to periodically audit performance against the CMS Elements and associated processes.
- The audits should determine if the CMS is properly implemented and maintained and is contributing to the overall goal of reducing the discharge of hazardous chemicals.
- Documents and records associated with the audit, including an audit plan, audit checklist and audit results, should be maintained.

7.1 AUDIT YOUR CMS (INTERNAL, EXTERNAL)

Once you have identified and selected internal auditors you need to design and initiate the internal auditing process.

At this point, you should have sufficient CMS processes in place to conduct meaningful audits. You may find it is easier to start with smaller, more frequent audits that to audit the entire CMS at once. Such early and smaller audits will help you to make ready adjustments to your CMS while also serving as a learning tool for your auditors.

Once the audit results are known, use a corrective and preventive action process to address any identified issues and problems.

Make sure that the audit records are managed in accordance your management process and audit procedures.

Elements of your audit procedure

- ☑ audit planning
- ☑ audit scope (areas and activities covered)
- ☑ audit frequency
- ☑ audit methods
- ☑ key responsibilities
- ☑ reporting mechanisms
- ☑ Recordkeeping

Sources of Evidence

- interviews
- document review
- observation of work practices

7.1 AUDIT YOUR CMS (INTERNAL, EXTERNAL)

For your internal audit program to be effective, you should:

- develop audit procedures and protocols;
- determine an appropriate audit frequency;
- select and train your auditors; and,
- maintain audit records.

Even if you have an effective internal audit program, consider periodic external audits to ensure additional objectivity of your performance assessments.

► The ZDHC has its own audit protocol. You can refer to the Higgs FEM 3.0 tool for self-assessment and auditing of the CMS. www.roadmaptozero.com/programme/audit-protocol/

Where do you stand

- Have you developed an CMS audit program? If not, how will this be accomplished?
- Has it been decided who needs to be involved in the audit process?
- Have you checked whether there is another audit program with which our CMS audits could be linked (for example, our quality, EMS or health & safety management system audits)?
- Have you determined an appropriate audit frequency? What is the basis for the existing frequency? Should the frequency of audits be modified?
- Have you selected CMS auditors? What are the qualifications of our auditors?
- What training has been conducted or is planned for our CMS auditors?
- Have you conducted CMS audits as described in your audit program? Where are the results of such audits described?
- How are the results of audits communicated to your top management?
- Has it been decided how are the records of these audits maintained?

7.2 CONDUCT MANAGEMENT REVIEW

The key question that a management review seeks to answer is:

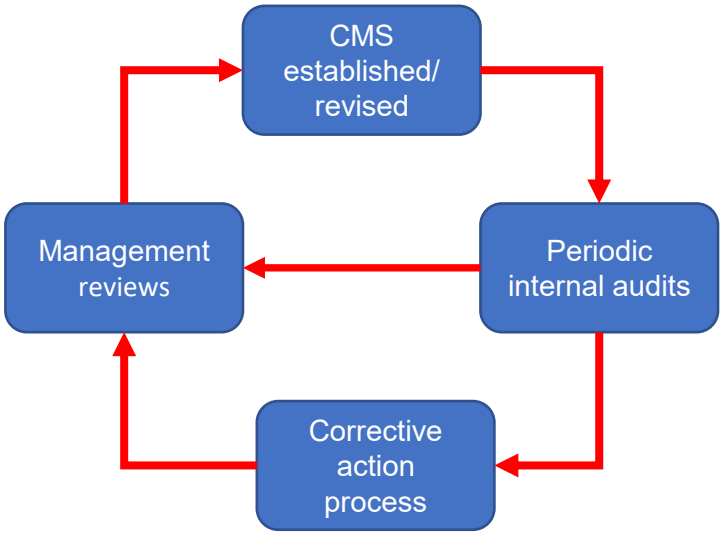
"Is the chemical management system working?" (i.e., is it suitable, adequate and effective, given our needs?)

- As per ZDHC CMS, your company is expected to establish, document and implement a process for periodically engaging with top management to determine the suitability and effectiveness of the CMS.

For example, check:

Is your management aware of the ZDHC 11 or other priority chemical groups and respective goals?

Linkages among CMS audits, corrective action and management reviews



7.2 CONDUCT MANAGEMENT REVIEW

MANAGEMENT REVIEW: SUGGESTED QUESTIONS TO ASK YOURSELF

- Did we achieve our objectives and targets? If not, why not? Should we modify our objectives?
- Is our chemical management policy still relevant to what we do?
- Are roles and responsibilities clear, do they make sense and are they communicated effectively?
- Are we applying resources appropriately?
- Are our procedures clear and adequate? Do we need other controls? Should we eliminate some of them?
- Are we fixing problems when we find them?
- Are we monitoring our CMS and performance (e.g., via system audits, performance checks)? What do the results of those audits tell us?
- What effects have changes in materials, products, or services had on our EMS and its effectiveness?
- Do changes in laws or regulations require us to change some of our approaches?
- What other changes are coming in the near term? What impacts (if any) will these have on our CMS?
- What stakeholder concerns have been raised since our last review? How are concerns being addressed?
- Is there a better way? What can we do to improve?

Information sources to consider:

- Audit results
- Internal suggestions
- External communications
- Progress on objectives and targets
- Other chemical performance measures
- Reports of chemical emergencies, spills, other incidents
- New or modified legislation and regulations and customer requirements
- New scientific / technical data on materials and processes used by the organization

7.2 CONDUCT MANAGEMENT REVIEW

Example of agenda points for a management review

- ☐ Follow-up actions from previous management reviews
- ☐ Chemical management performance of the company
- ☐ Extent to which objectives and targets have been met
- ☐ Results of internal/external audits
- ☐ Results of evaluation of compliance with legal and other requirements Status of corrective and preventive action
- ☐ Communication from external parties, including complaints, praise,….
- ☐ Changing circumstances, including developments in legal and other requirements (e.g. changes in MRSL, RSL,…)
- ☐ Other recommendations for improvement
- ☐ Proposed changes to the chemical management system
  - ☐ Chemical management policy
  - ☐ Risk assessment or other procedures
  - ☐ Objectives, targets and programs/plans
- ☐ Other elements

7.3 REPORT CHEMICAL MANAGEMENT PERFORMANCE

Reporting of your chemical management performance may be a legal requirement or voluntary effort to engage with your company`s various stakeholders.

Industry surveys indicate that non-financial performance reporting improves stakeholder dialogue, results in reputational improvements, increases employee awareness, leads to stronger internal commitment and provision of environmental, health safety information and can opens new market opportunities.

According to your target group (e.g. employees/ workers, trade, direct customers, end-users, shareholders/investors, public, authority) you may consider different formats and modes of reporting (e.g. marketing materials, brochures and flyers, public announcements, press releases, assured reports, performance boards,…).

Do Good and Talk About It!

Practical tips

- ► Ideally, incorporate your reporting on the chemical management performance in your company`s overall sustainability performance reporting.
- ► Consider referring to a specific recognized, reporting standard, e.g. Global Compact, Global Reporting Initiative,…

7.3 REPORT CHEMICAL MANAGEMENT PERFORMANCE

List of elements that should be part of the company performance report:

- ☐ A statement of commitment from the CEO or equivalent;
- ☐ A review of the nature of the business;
- ☐ An explanation of how the company determined what issues are needed to manage and an explanation of the issues;
- ☐ An explanation of how stakeholders were involved;
- ☐ A description of company goals, objectives and targets;
- ☐ Information on how has the company performed against the goals, objectives and targets;
- ☐ A statement on future plans for improvement;
- ☐ A statement of future goals, objectives and targets;
- ☐ A statement on any standards or guidelines used for reporting;
- ☐ An independent assurance statement.

Source: UNEP RP

- ▶ As per the ZDHC CMS, your company is expected to establish, document and implement a process for periodically engaging with stakeholders to determine the suitability and effectiveness of the CMS.
- ▶ Stakeholders are be given data on the status of the CMS that includes 1. Progress toward goals, 2. audit results, 3. status of change management and corrective actions and 4. regulatory changes
- ▶ Report on progress of priority chemical phase-out

FOR FURTHER REFERENCE

In this part of the tookit, you will find an overview of reference materials, which help you with the practical implementation of your chemical management system.

Reading Materials

Handouts/ Worksheets/ Templates

About this publication

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